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Electrical World

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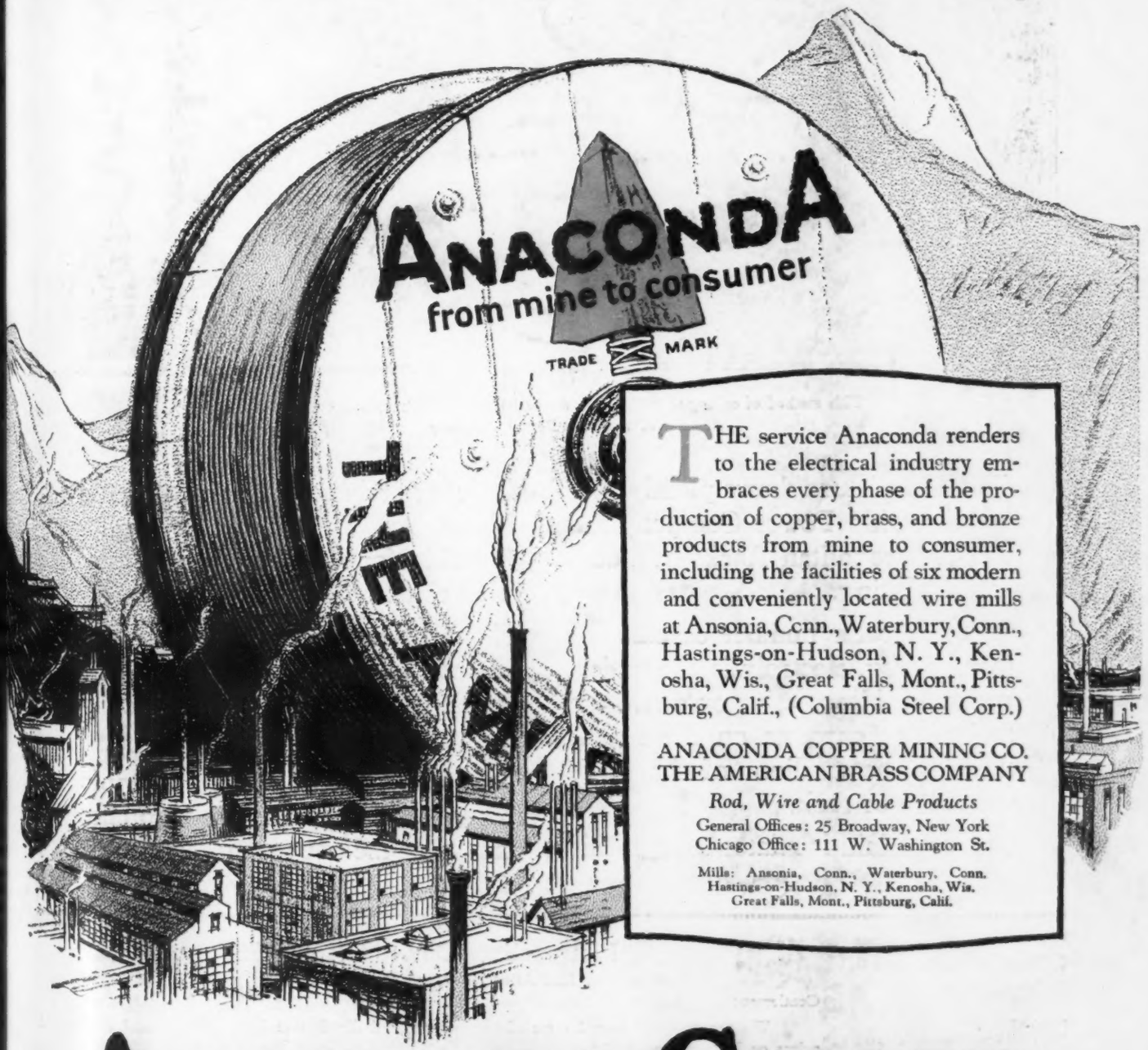

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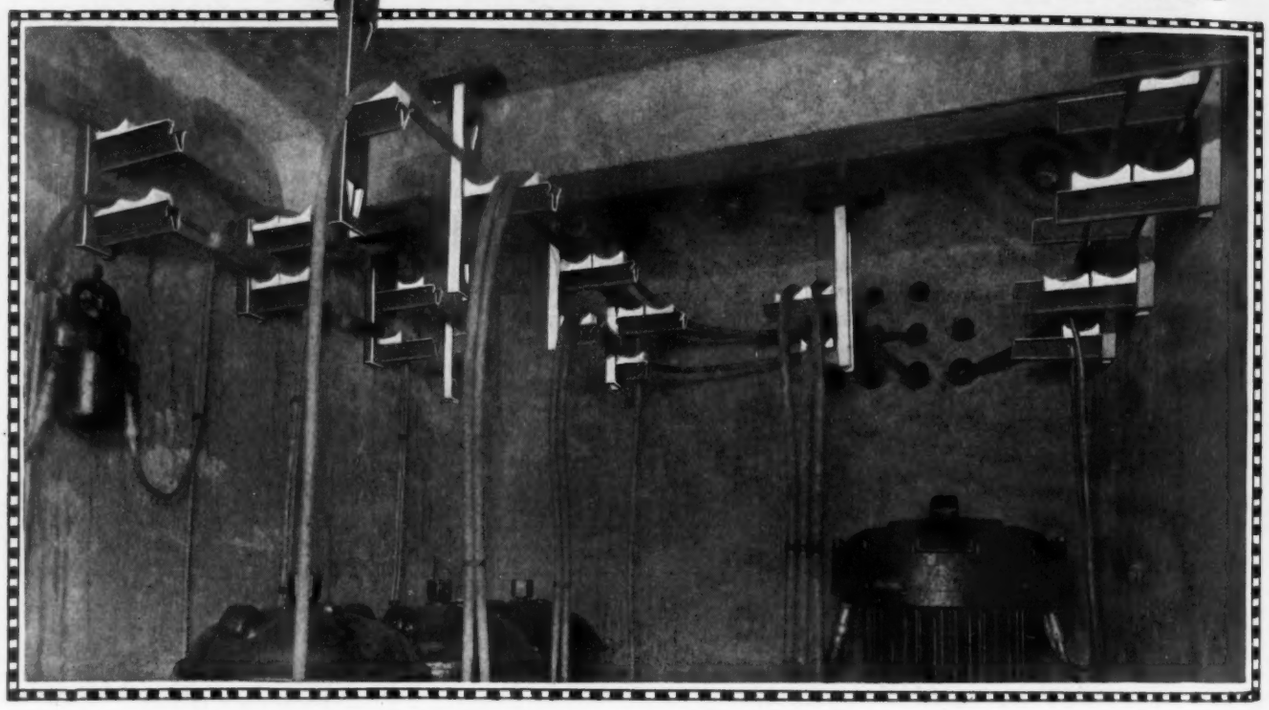

This method of ceiling mounting was devised by J. W. Fulmer and W. H. Salberg of the Ohio Power Company

THIS picture shows plainly how the Ohio Power Company has used Metropolitan Racks in a ceiling mounting.

In the greater number of cases of trouble from electrolysis, the underground cables receive or discharge their stray currents on the sheath through the medium of the cable stanchion or rack.

The porcelain insulator used in this device entirely prevents trouble from this source, and makes it highly desirable for all power and signal cable construction.

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Electrical World

THE CONSOLIDATION OF ELECTRICAL WORLD, ELECTRICAL ENGINEER AND AMERICAN ELECTRICIAN

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W. H. ONKEN, JR.

Editor

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Flotations of Foreign Electrical Industrial and Utility Securities

THERE have been floated in this country within the last year securities of electric public utility and manufacturing companies of foreign countries to the value of a quarter of a billion dollars. German, Austrian, Swiss, Italian and Japanese concerns were the chief seekers of American gold. Their search for funds in the United States is not surprising. While New York remains the money center of the world, offerings of foreign securities are inevitable. Indeed, if we are to prosper as a nation, we must seek foreign outlets for our gold. However, a word of caution is not out of place with reference to investments in the public utilities of foreign lands. These investments are not hedged about with the same safeguards that obtain in this country. Besides, the stability, or, rather, the instability, of the currency must be reckoned with. The dollar may be without much honor on American soil, but it is sought after eagerly and highly prized and coveted abroad. Then there are limitations on franchises, mortgages and loans, not to mention the intricacies of banking laws, taxes, etc., to be taken into consideration, besides market conditions.

In anxiety to render financial aid to foreign countries, and particularly to foreign electric public utility companies, sight must not be lost of the differences between American and foreign conditions, nor must prudence be thrown to the winds. The ELECTRICAL WORLD is not seeking to check foreign investments of the type mentioned or to sit in judgment on what has been done. Caution and investigation are all it suggests, and the State Department or the Department of Commerce in Washington can be of great assistance in this regard.

Litigation at a Discount in Wisconsin

WISCONSIN of all states is the one where the well informed would least expect to find the public utility commission departing from an impartial attitude to lean toward the view of the utility companies rather than toward that of the public where these conflict. Nor does it. On the contrary, many utility companies in that state think that their rate schedules ought in perfect fairness to be higher than the commission permits them to be. None the less, the president of the Wisconsin Utilities Association announced with justifiable pride at a recent convention of that body that not a single appeal in the matter of rates had in twelve months been taken by a public utility company from the commission to the courts. It is judged wiser to swallow the loss and run no risk of impairing good public relations.

Wisconsin has set a praiseworthy example. Of course, there is a limit to forbearance, and duty to stockholders always compels resistance to rates clearly confiscatory. So long, however, as this point has not been reached a cheerful acquiescence in the commission's judgment is the winning policy. With the widespread distribution of dividend-paying securities among customers the day is coming when wrangles about rates will no longer be a usual incident in the regulation of utility companies. On this foundation of mutual interest the permanent structure of private ownership must be built. Appeals to the courts often bring increased income, but if this comes at the expense of public good will, it comes dear. The findings of the higher judicial tribunals cannot be upset, but often, however just, they contain the seeds from which spring political agitation and demands for municipal plants. In the long run propitiation will accomplish results that litigation is powerless to achieve.

Water Power in West Virginia

A WATER-POWER commission is the latest attempt of West Virginia to solve the problem of water-power development. This commission presumably will advise the Legislature on the policy to be followed in water-power development and will assemble statistics on available power resources. In these respects the commission follows along the lines of those studying the subject in other states.

But in many ways the water-power situation is difficult in West Virginia. The state has great resources in coal, oil, gas and lumber, and much ado is made by politicians because most of these resources were developed by men of other states and most of them were transported for use beyond the borders of the state. It is claimed, therefore, that the water-power resources at any rate must be saved for the people of the state. Another element in the problem is that the coal interests are very strong politically in West Virginia, and they are said to be greatly opposed to water-power developments from a selfish standpoint.

An unbiased analysis of conditions shows that the water powers of West Virginia can be used to good advantage only when tied into big interconnected systems. They are typical fugitive Appalachian waters, with great variation in flow during a season, and should therefore be utilized to secure the greatest diversity between watersheds and to put their energy into systems with the greatest ability for absorbing secondary power. Power companies seeking to develop these resources fully acquiesce in any state control based on the federal water-power act and realize that the greatest use of the power will be within the borders of the state. An abundance of power combined with an undeveloped labor supply are the essentials to industrial development, and North Carolina and Tennessee present typical examples of the developments that occur when a state welcomes regulated power development.

It is to be hoped that the thinking people of the state will realize the benefits of water-power development and

not add the name of West Virginia to the small list of others which follow a do-nothing or dog-in-the-manger policy, greatly to the detriment of their own and the nation's industrial growth.

Railroad Expansion Duplicated in Advance of Interconnection

EVEN with the present marked tendency toward more and more interconnection of electrical systems, occasions arise where a company in building new lines fails to take into consideration the possibilities of interconnection at some later day. Fortunately clashing opinions regarding frequencies no longer exist; but there are still differences of opinion regarding voltages. When the voltage bears some definite relation to that which has already become standard in the district interconnection involves only simple transformations. But when voltages not in harmony with those in adjacent sections are chosen interconnection is made more costly and difficult. Hence the desirability of designing transmission systems with some reference to those already in operation, even if interconnection appears improbable. Many things besides technical ability are required of engineers nowadays, and one of them is good judgment. Not long ago an electric public utility company in the Middle West took issue with another prominent utility group in that section on this question of transmission voltage, and even registered its objections with the public service commission of the state.

It is unfortunate that one public utility group should cross another public utility group in this fashion, but it indicates how serious the problem may become and suffices to show the necessity for giving consideration to electrical conditions outside of one's own immediate territory. Differences of voltage are more easily remedied than differences of frequency; but both are endowed with public interest if they lead to non-standard equipment, or add to the cost or jeopardize the reliability of the service.

Analysis of Fire Losses

OF THE total fire losses in the nation of more than five hundred million dollars in 1923, those of reputed electrical origin contributed 2.6 per cent. This apparently small proportion is an increase for the first time since 1918, and an interesting analysis is given by Reginald Trautschold in his article on page 923 of this issue of the reasons for the increase. It seems that the losses increased in territory where electric service was rapidly expanding and decreased in territory where electricity was most generally used. It is argued therefore that one reason for the increase in losses was lack of familiarity on the part of the customers with electric service and its proper utilization, and Mr. Trautschold holds that it is the duty of the electrical industry to disseminate information that will alter this condition. The reason given for increased losses in rapidly expanding electrical territory may be true, but another element in the situation may be the prevalence of building on a minimum-cost basis in order to meet the high prices now encountered. Factors of safety in building construction and electrical installations may have been reduced to lower costs, and the tremendous growth in building may have placed a bursting pressure on inspection departments. The true story of electric fire losses is always difficult to obtain, and many reasons can be given for increases or decreases in a given territory. The fact remains that electricity is the safest and most useful agent in the homes and industries of America, and no fear of fire has any effect in dampening the enthusiasm of customers for electric service.

However, it is the duty of electrical men to install foolproof electrical equipment that has a minimum fire hazard attached to its use. There should not be any necessity for customers to be educated in the use of electricity to prevent fires. The greatest advantage of electricity is, or should be, that it can be used safely by any one at any time, and the industry must see that installations and equipment conform to this specification.

A 75,000,000-Kw. Industrial Electric Heating Load

INDUSTRIAL electric heating has been on a commercially economical basis for the last nine or ten years, but it still remains the largest of the undeveloped fields for the application of electrical energy to manufacturing processes. Competent engineers estimate that with the electrical equipment now available and under existing rates for this class of service there is a potential electric heat load at least equal to the present motor load. Further refinements in apparatus and methods of use are expected to double or treble the possible economical applications. As the total connected motor load in the United States is approximately 31,500,000 hp., or nearly 24,000,000 kw., this means that an eventual electric heating load of about 75,000,000 kw. may be looked for.

That the above three-to-one ratio of heating to motor load is substantially correct and not an overambitious estimate is borne out in the industrial electric heating survey being conducted by the Edison Electric Illuminating Company of Boston. An analysis of 134 of this company's industrial customers shows a total connected lighting and power load of 17,500 kw., an already connected electric heating load of 1,500 kw., a potential or immediately economical electric heating load of 12,500 kw. and a deferred future load of 33,000 kw. This is particularly significant when compared with the rest of the country as most of the prospective users in the Boston Edison territory would require electric heating apparatus of only moderate size and there are few opportunities for the sale of such equipment as steel furnaces or large japanning ovens having heavy individual demands.

In spite of these possibilities, industrial electric heating continues almost a virgin field for the connected load of all existing installations, which, including heat treating, steel and brass melting furnaces, welding, industrial ovens, commercial cooking and miscellaneous equipment, totals, in round numbers, 1,200,000 kw., or only 5 per cent of the present motor load. Thus the economically feasible field for electric heating has been developed to about the same small degree of saturation as was that of the electric motor twenty or twenty-five years ago.

The benefits of electric heat application to the manufacturing processes of industry promise to exceed what the electric motor has already accomplished in speeding up and lowering the costs of production. Heating

processes frequently have an advantage over mechanical operations in that they can be carried on by means of automatic control with little or no human attendance during off-peak hours at a very low rate for energy. Other benefits of definite monetary value are improved quality of products, less spoilage and often direct lessening of manufacturing costs. These are all most desirable to the industrial plant operator who is willing to be shown where and how electric heat can be profitably applied.

To meet this industrial opportunity it is up to the central-station companies and to the manufacturers of electric heating equipment to provide, respectively, an adequate engineering sales service and the right kind of electrical apparatus. Central-station commercial men, to fill up the valleys in their load curves, should specialize on the practical applications of electric heating and then go out and get the business that is waiting in almost every power customer's plant on their lines. Electrical manufacturers should not be content with the mere development of a satisfactory piece of heating apparatus and then, figuratively, hide their light under a bushel. Instead, when a new or unusual installation is in successful operation its details should be heralded throughout the industry.

A possible heating load of 75,000,000 kw. is a sizable target to shoot at. Based on a gross return of only $20 per kilowatt, it would bring a total annual revenue from the sale of energy of a billion and a half dollars—more than the total gross revenue of all the central-station companies from all sources in 1924. This does not include the price of the equipment itself, which would be several times the cost of the energy to operate it for one year. But a load of 75,000,000 kw.—a hundred million horsepower—is worth a lot of study and investigation, and the central-station industry and electrical manufacturers can together well afford to spend a considerable amount of time and money to develop even a part of it.

First Use of Inventions Often for Purposes of Destruction

AT THE recent A. I. E. E. convention in St. Louis Chester I. Hall described a vibration recorded by means of which tremors characteristic of various diseases can be recorded on sensitized paper. Entirely as a side issue, he also showed an application of the device to rifle marksmanship. Yet he said, with some bitterness, that while his direct purpose in developing this device has been to aid in medical diagnosis, the first large order came from the Japanese War Office. The authorities there were quick to recognize the value of the device in improving the soldiers' markmanship.

The great improvements in processes and machinery due to the last war are a matter of general record, and historians can point out similar great technical advances springing from other important wars. This relationship is not to be ascribed to the wickedness of humanity, but rather to the domination of fear and to the instinct of self-preservation. Except in times of danger, animals and savages lead purely automatic lives, and the general apathy of the civilized nations is most readily overcome by a war or the danger of one. There is nothing in this situation that engineers can help. Only let them not be discouraged by the thought that the best efforts of their training and imagination must be first applied in the cause of hatred and destruction. Out of the last war came better production, better metals, wonderful chemistry and commercial airplanes. The acetylene torch has proved to be a mighty help to the burglar attacking a safe, but its legitimate applications greatly outweigh its abuse.

A Service Requiring the Support of Water-Power Companies

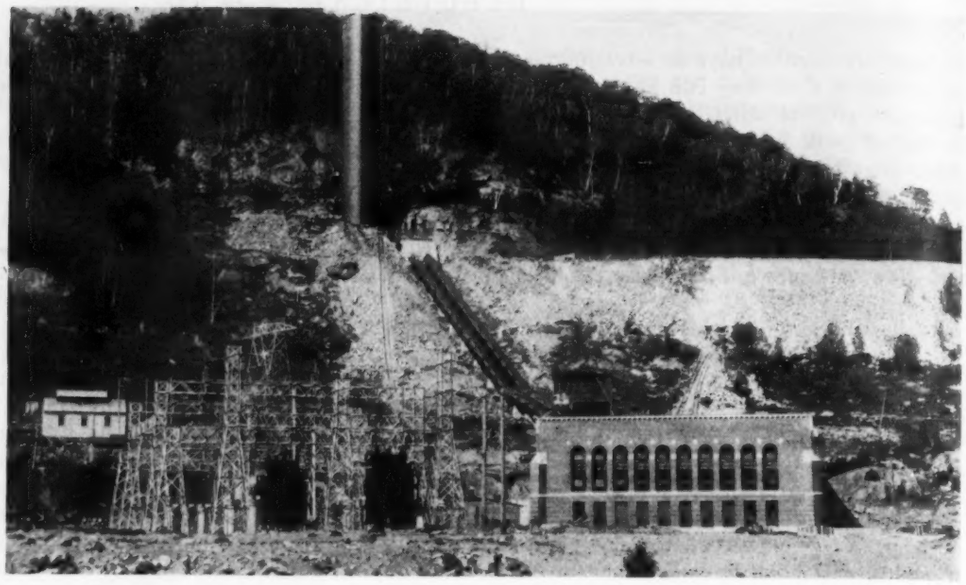
OWING to a reduction by Congress in the appropriations allowed the United States Geological Survey, it is possible that its work in connection with stream gaging may be curtailed during the coming year. While economy in government expenditures is greatly to be commended, work of this kind, which is purely governmental in character and of service to industry, should not be curtailed. No unrelated private agency is equipped to undertake it, and since, under past appropriations, there have been undue delays in publication of stream-flow records, it would appear wise to increase the appropriations rather than reduce them. Individual utilities, local and group associations and others who make use of the stream-flow data of the Geological Survey can help check these short-sighted attempts at economy by bringing them to the attention of their congressmen.

Find the Cost of Serving Electric Ranges

THE investigation of electric range load characteristics recently made by the Narragansett Electric Lighting Company in Providence illustrates a type of individual research which other central-station companies could profitably follow. This company had on its lines a number of electric cooking customers whom it suspected were being served at a loss; but, instead of announcing a general policy looking to discouragement of further range sales, definite steps were taken by the Narrangansett company's commercial department to ascertain exactly what the load meant in increased demand, diversity factor, cost to serve, revenue and so forth. These data obtained, a domestic cooking and heating rate was made effective which the company feels is adequate to cover all costs regardless of whether one or ten thousand ranges are on its lines. As a result people in Providence used their electric cooking equipment last year at an average cost of only 3.24 cents per kilowatt-hour, the company made a profit, and the number of users is growing steadily.

There are still companies attempting to dodge the electric range issue, believing ranges an undersirable load but lacking definite data to back up that belief. Uncertainty about the electric range will be largely cleared up by the electric heating and cooking committee of the N. E. L. A. Commercial National Section when it reports its ultimate findings. Unfortunately, complete data from the study which this committee is making in the Northwest are unavoidably delayed until 1926. Meantime, those central-station companies which are marking time on their range policy could uncover much information useful to themselves and the industry if they would carry on investigations in their local territories as the Narragansett Electric Lighting Company in Providence has done to its profit.

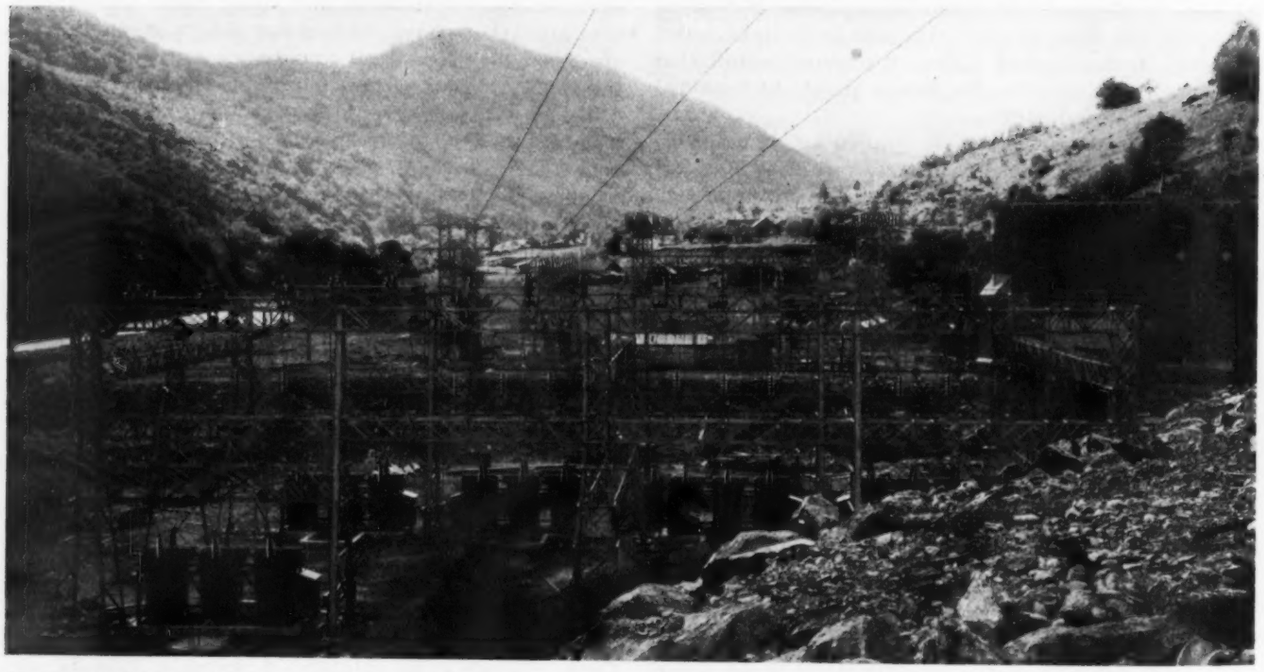
Davis Bridge Development of the New England Power Company



At top—Davis Bridge station of the New England Power Company and 110-kv. switching yard.

Center—66,000-volt switch station of this ultimate 48,000-kw. development.

At bottom—Airplane view of earth-filled dam 2.5 miles from generating station.



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ANOTHER step toward the complete economic utilization of the hydro-electric possibilities of the Deerfield River has been taken by the New England Power Company in the purchase of a third and concluding unit for its Davis Bridge plant. Rounding out this development to 60,000 hp. will add a yearly net total of 136,000,000 kw.-hr. to the system's generating facilities.

The company plans ultimately to operate nine stations, developing 200 kw. per square mile of drainage area, or a total of 110,000 kw. for the stream. An annual output of 400,000,000 kw.-hr. can be realized on this comparatively small river by developing a total drop of 1,600 ft. At present six stations are in service, with 1,050 ft. developed. The river is only about 70 miles long from its mouth to its northernmost reservoir.

With the completion last year of the Davis Bridge reservoir, virtually complete flow control has been obtained. This reservoir is formed by an earth-filled dam 200 ft. high, 1,250 ft. long and 1,200 ft. wide at the base. Its storage capacity is 38,000,000 gal., and a power tunnel 2.5 miles long (normal capacity 1,400 cu.ft. per second) delivers water to the wheels under a mean head of 350 ft.

Experience with Resistance Welding

Field of Application—Spot, Seam and Butt Welding Considered — Mechanical Strength of Welds — Success in Welding Different Thicknesses of Metals

By C. A. HUGHES*
Electrical Engineer Truscon Steel Company, Youngstown, Ohio

INCLUDING spot welding, seam welding and butt welding, whether made by the upset, flash or the new contact-flash process, resistance welding is more generally used today in the manufacture of commonly employed articles than all other methods of welding combined. Its use extends from the welding of the stems on watches, through welding frames on eyeglasses, handles on knives and forks, rims and frames of baby carriages and automobiles, rims and frames for truck wheels to rims on passenger locomotive wheels.

Nearly all metals and alloys, tin being the notable exception, can now be welded by some one of the resistance processes. Tin can be welded, but the weld deteriorates so rapidly that it will fall apart the next day due to what is called "skin disease." Lead, which was formerly very difficult to weld, can now be readily welded by the contact-flash process. Welding of stellite, which has been the cause of many disappointments and discouragement in the past, is now being successfully accomplished and the metal is superseding high-speed steel at much lower cost. Brass is in a class by itself, since the ease with which it can be welded varies with the copper and lead content of the particular sample being welded. Duralumin, if welded by gas, requires treating or annealing after welding to prevent deterioration by the presence of moisture, but when electrically welded requires no such treatment and the weld is as strong as the original metal. Some grades of steel require annealing after the welding to restore normal strength.

THICKNESS NO LIMITATION

At the present, it appears that the cross-section of stock that it is possible to weld by the resistance process is limited only by the electric power available. Wires as small as electric-light-bulb filaments represent one extreme welding possibility and cross-sections measuring 16 to 20 sq.in. represent the upper possibility now. However, welders could be built to weld practically any large cross-section.

The question now arises, Where should spot welding be used, and what thicknesses of plate is it practical to weld? To decide whether it is better to rivet or spot weld an article, a person must take into consideration the use of the article. Sufficient welds can be inserted to obtain maximum strength of the metal welded. In general, spot welding is preferable for all work in which a smooth surface is desired, or where the stock will not permit the punching or countersinking of rivet holes. It is safe to say that spot welding can replace 90 per cent of the light work now being done. Special machines can be built to take care of different shapes. The saving in time and labor for maintenance of jigs, dies, punches and so forth have been as much as 75 per cent in some cases. Spot-welded joints can be made as strong as riveted joints and in a good many cases stronger. Resistance-welding machines can be successfully used in heating and driving rivets. Where several welders are used, the source of supply should be about 66 per cent of the total rated kva. of the welders. The thickness of the material to be successfully welded will depend upon the size and shape.

To show more definitely the applicability of spot welding, some specific experiences may be cited. For example, two pieces of steel (Fig. 7*a*) 3 in. wide and

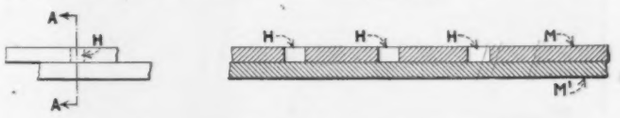


FIG. 1—PRINCIPLE OF ARC-SPOT WELDING

The upper plate *m* is punched and laid on lower plate *m'*, which is not punched. The holes *h* are then filled with metal by an arc welder, the spots acting as rivets. Where a limited amount of this class of work is required, it has advantages over rivets, since equipment for welding is much chearer than the air equipment for driving rivets; also only one plate need be prepared. This method is still in the experimental stage and reliable data on tests are limited as to the cost and strength per weld on various size plates.

½ in. thick, were spot-welded on a 30-kw. hand-operated machine. A tension test of this sample (all tension tests were pulled at ½ in. per minute) was 35,100 lb. The total area of the weld sheared was 0.65 sq.in. The reason for this low tension test is that sufficient pressure to force the material together after heating could not be obtained on the welding machine used. In testing two pieces of No. 12 gage steel (Fig. 7*b*) that were spot welded, one spot pulled out of one sheet entirely. The nature of the union between two pieces of ½-in. metal is shown in Fig. 8*a*. When an attempt was made to separate the two pieces by driving a chisel between the ends, they were sprung apart before the weld itself separated (Fig. 8*b*).

WELDED METALS DO NOT REQUIRE SAME THICKNESS

The fact that two pieces of metal do not have to be of the same thickness to insure a perfect spot weld is shown quite conclusively in Fig. 9. A piece of No. 14 gage steel welded to a piece of ¼-in. plate (Fig. 9*a*), in being pried apart with a chisel, could be separated only after the weld pulled out of the sheet. The nature of the metal union between two similar thicknesses of metal is shown in Fig. 9*b* after the No. 14 gage sheet was driven back by a chisel and the sample cut through center of the weld. Another example of the parent metal tearing before the weld failed is shown in Fig. 9*c*,

*Assisted by R. H. Pool, assistant electrical engineer Truscon Steel Company.

which represents two pieces of No. 14 gage sheets spot welded at one point. Experience has also shown that a No. 30 gage sheet can be welded to a 1-in. piece of steel. Double-lap and single-lap joints made by spot welding are shown in Figs. 10*a* and 10*b* respectively. Both welds were made with four spots, the double-lap joint being made with $\frac{5}{16}$-in. electrodes and the single-lap with $\frac{3}{16}$-in. electrodes. The plates measured 3 in. wide by $\frac{5}{32}$ in. thick. On test, the double-lap joint failed at 25,500 lb., which indicated that the shearing strength of the four spots was greater than 6,500 lb. each. The single-lap joint failed at 25,050 lb.

Two other welded samples developed equally good test results (Fig. 11). Two pieces of steel 2x$\frac{3}{8}$ in.

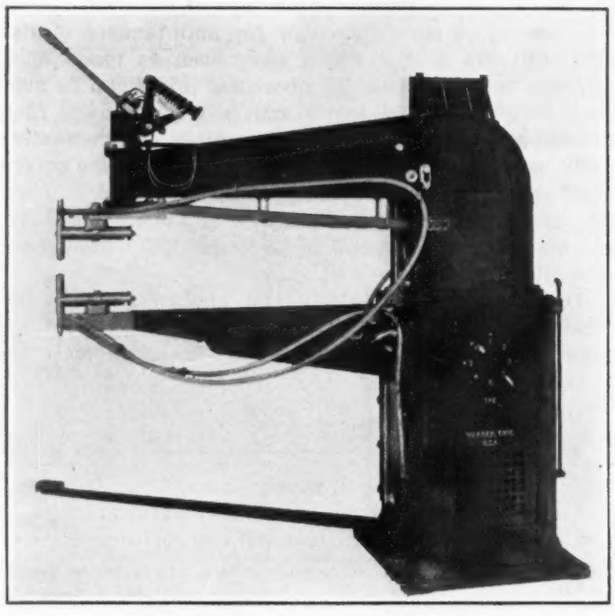


FIG. 2—TYPICAL HAND-OPERATED SPOT WELDER

thick welded with four spots having a total area (measured by planimeter) of 0.476 sq.in. separated at 44,650 lb. tension. A piece of this same steel showed an ultimate tensile strength of 66,800 lb. per square inch. This would indicate that the shearing strength of the weld is greater than the tensile strength of the material. Upon careful examination, the welds showed that they were under both tensile and shearing stresses. Two pieces of $\frac{1}{4}$-in. steel with four spots having a total area of 0.54 sq.in. (Fig. 11*b*) developed a strength of 45,800 lb. under a tension test, or an average of 11,450 per weld.

TABLE I—COMPARISON OF SHEARING STRESSES OF SPOT WELD AND RIVETED JOINTS IN NO. 14 GAGE SHEETS TESTED IN SINGLE SHEAR

Test No.	Size of Spot, In.	Maximum Load, Lb.	Nature of Failure	No. of Spots
1	$\frac{5}{16}$	4,460	Weld pulled out	1
2	$\frac{5}{16}$	7,250	Welds pulled out	2
3	$\frac{5}{16}$	10,920	Welds pulled out	3
4	One $\frac{1}{4}$-in. rivet was used,	2,920.	Rivet sheared, hole drilled and rivet inserted with care.	
5	Two $\frac{1}{4}$-in. rivets were used,	4,700.	Rivets sheared, holes drilled and rivets inserted with care.	
6	Three rivets were used, holes	8,390.	Rivets sheared, holes drilled and rivets inserted with care.	

TABLE II—CONDITIONS OBTAINED IN WELDING TWO DIFFERENT MATERIALS

Volts	Amp.	Kw.	P.F.	Material Used	Time in Sec. to Heat	Lb. Pressure to Heat	Size of Spot, In.
220	244	24	0.54	Two $\frac{3}{16}$-in. mild steel plates	15	100	$\frac{1}{2}$
220	260	20	.35	Two $\frac{1}{4}$-in. Vasco non-shrinkable	20	50	$\frac{1}{2}$

A comparison of the shearing strength of spot welds and $\frac{1}{4}$-in. rivets using No. 14 gage sheet steel in single shear is afforded by Table I. All test pieces were 3 in. wide. The single-spot welds were made in the center of each sheet, $1\frac{1}{2}$ in. from the edges. The two-spot welds were placed on 1-in. centers and 1 in. from the edges; the three-spot welds were made in the form of equilateral triangle, 1 in. on centers and 1 in. from edges. The rivets were located with the same relation to each other as the welds.

As a result of these tests, it was found that the sample with one spot tested higher than the average of the two- and three-spot samples, as did also the riveted samples. This performance was probably due to the welds and rivets not shearing the load equally, with the result that one was partly ruptured before the others were fully loaded.

During welding it was noticed that some pieces heated much more rapidly than others, so a careful study was made to determine why this condition was so pronounced. It was recognized that the heat generated depends upon the amount of current flowing and the resistance of the circuit, the resistance depending upon the pressure. Rust, scale and so forth cause burning of the sheet under the electrodes, thus giving the appearance of a welding heat despite the fact that the point of contact is not hot enough to weld, thus resulting in poor or burned welds. If too much pressure is applied, the resistance is lowered and the sheets are slow in heating to a welding heat. If the pressure is too light, sparks will be thrown off and the welds will be poor.

TABLE III — COMPARISON OF WELDS MADE WITH SINGLE-SPOT MANUALLY OPERATED MACHINE AND AUTOMATIC AIR-OPERATED TWO-SPOT MACHINE

Material—Two No. 14 gage plates and one 3/16-in. plate arranged thus: Two spots in each specimen

	Automatic Two-Spot Machine							Single-Spot Machine						
	A_1	A_2	A_3	A_4	A_5	A_6	Ave.	B_1	B_2	B_3	B_4	B_5	B_6	Ave.
1. Voltage	208	206	202	204	208	202	205	212	212	211	211	210	212	211.3
2. Current	296	344	352	360	344	352	341	240	245	242	240	240	240	241.1
3. Top of auto transformer	7	8	8	8	8	8	.....	8	8	8	8	8	8	.....
4. Kilowatts consumed	38.8	41.6	41.2	41.6	42.0	41.2	40.73	24.5	24.5	23.5	24.0	23.5	23.5	23.91
5. Power factor	60	59	58	57	59	58	58.5	48	47	46	47	47	46	46.83
6. Condition of sheets							Fair							Fair
7. Condition of electrodes							Good							Good
8. Size of contacts (ins.)	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/16	7/17	7/16	7/16	7/16	7/16
9. Press. at electrode cont.	205 pds. to heat—1,060 lb. compress—							700 pds.						
10. Time of weld (sec.)	*12.0	5.4	6.6	9.0	8.4	8.4	8.3	†7.8	6.15	6.3	6.3	6.2	4.5	6.21
11. Area of weld	0.0494	0.0421	0.0648	0.0810	0.0629	0.0680	0.0614	0.1053	0.0910	0.0870	0.0852	0.0856	0.0840	0.0870
12. Condition of weld			Good								Good			
13. Nature of failure	Weld	Weld	Weld	Weld	Weld	Weld	.....	Weld	Weld	Weld	Weld	Weld	Weld	.....
14. Load at failure	15,670	13,190	19,700	17,700	18,950	16,790	17,000	10,970	18,310	18,165	18,520	18,060	19,760	17,297
15. Load per spot at failure	7,835	6,595	9,850	8,850	9,475	8,395	8,500	10,970	9,155	9,083	9,265	9,030	8,800	9,383
16. Current in weld	12,500	12,500	12,800	13,200	12,500	12,800	12,710	8,000	8,200	8,100	8,000	8,000	8,000	8,050

*Two welds. †One weld.

This condition can be remedied by increasing the pressure or lowering the current value. When rust or scale is present on heavy sheets and the correct pressure is applied, a good weld can be made by first switching the current on for an instant to burn the scale or rust off and seat the contacts firmly on the sheet. Then the current is switched on after the work is brought up to a welding heat. The pressure required varies with the thickness of the work, chemical properties of the material and amount of current used. Owing to its low resistance, high-carbon steel requires very light pressure and heavy current to heat. In some instances the steel will not heat if a great amount of pressure is used.

RESULTS OF WELDING TWO GRADES OF STEEL

Operating conditions experienced in welding two grades of steel—namely, low-carbon and Vasco non-shrinkable steel—on a spot welder (Fig. 2) with a 30-in. throat and having 35-kw. capacity are shown in Table II. The low power factor was caused by the inductive reactance set up in the low-voltage conductors. In making the weld with Vasco non-shrinkable steel approximately 9,000 amp. were flowing in the secondary circuit. Conductors carrying this heavy current parallel to the iron of the machine thus increased the inductive reactance. Furthermore, as the current passed through the sheet being welded, a choking effect was produced, depending upon the distance the sheet was inserted in the throat of the machine. This is most noticeable in welding the seam of a cylinder, the time required to weld increasing as the sheet is inserted into the throat. The power factor can be improved if both conductors of the welder are short or placed on the same side of the work. By so doing (Fig. 12) the steel being welded is kept outside of the magnetic loop and the inductive effect is reduced.

The preceding effect on power factor is better illustrated in Table III, the machines used being those shown in Figs. 2 and 12 respectively. During the test with both machines, the regulating transformer was on tap No. 8, which puts the welding transformer across the line. The voltage drop on the automatic two-spot machine was a little greater than that on the single-spot machine, the energy consumption was nearly double and the power factor greatly improved. The current on a two-spot welder was about 50 per cent greater and 12½ per cent longer time was required to make the weld. However, two spots were made at the same time with a two-spot welder, permitting about 78 per cent greater production. Furthermore, the electrical characteristics are better and the welds more satisfactory. The power factor on the two-spot welder averaged 0.58; that on the single-spot welder was 0.46. The ultimate tensile strength of a piece of the No. 14 gage plate under test showed 56,500 lb. per square inch. The ultimate shearing load per weld (two spots) averaged 8,942 lb., the average area of each weld being 0.1104 sq.in. This would give an ultimate shearing strength for 1 sq.in. of weld of about 40,500 lb., and provides a ratio of average ultimate shearing strength of weld to average ultimate tensile strength of 13 to 16. Under ideal conditions the ultimate shearing approaches the ultimate tensile strength.

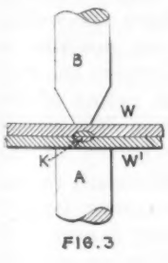


FIG. 3

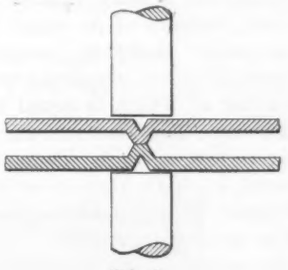
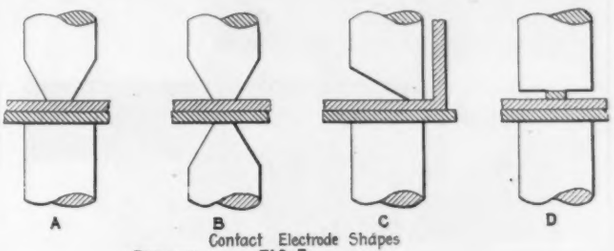


FIG. 4

FIG. 3—PRINCIPLE OF SPOT WELDING. FIG. 4—PROJECTION WELDING

Fig. 3—Resistance between copper contact electrode (*b*) and the work (*w'*) and electrode (*a*) and work (*w*) is less than that between work (*w*) and (*w'*). As a result of this the greatest heat is produced at point *k*, just where it is needed. When metal in contact with the electrodes (*b*) is in a plastic state (just before fusing) added pressure on (*b*) forces the molten metals together and makes a weld at *k*.

Fig. 4—This method of welding has proved satisfactory on small work where the projections can be made at the same time material is formed or stamped, one die performing both operations. This method has been used successfully in the making of brush holders for motors and generators.



Contact Electrode Shapes
FIG. 5

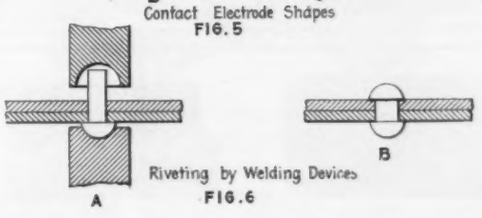


FIG. 6

FIG. 5—DIFFERENT TYPES OF CONTACT ELECTRODES. FIG. 6—METHOD OF RIVETING PLATES WITH WELDING MACHINES

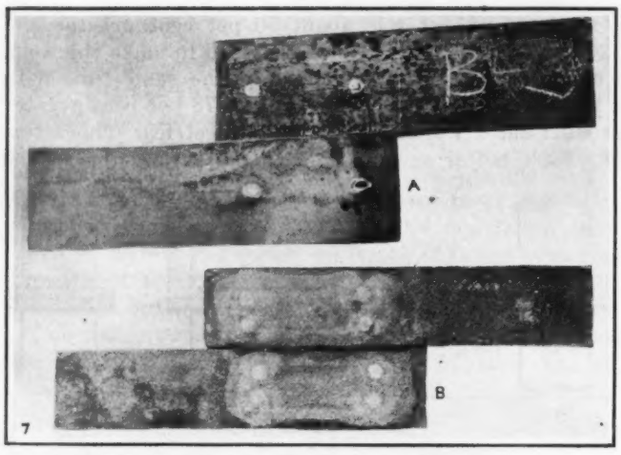
Fig. 5—On comparative test, type *A* lasted 50 per cent longer than any of the others and speeded up production 3 per cent by reducing the time required to dress the points. Type *C* is used for close work in corners; type *D* forces the button or slug into the work.

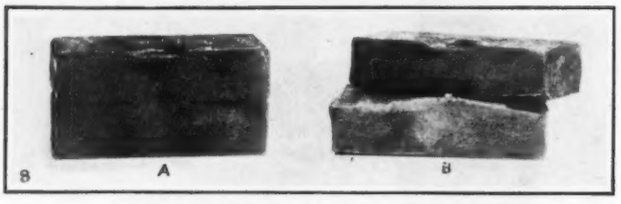
Fig. 6—This method is successful on rivets up to ¾ in. using copper electrodes. With larger rivets a special steel die is required for upsetting, as the copper is too soft. This method of riveting is ideal, because the rivet is hottest when completely upset and in cooling makes a tighter joint. The method is also preferred in some instances because it is noiseless and the welder is less expensive than a forge and the necessary air equipment to operate the air guns. In some instances it has proved economical by speeding up production over the air guns and driving rivets.

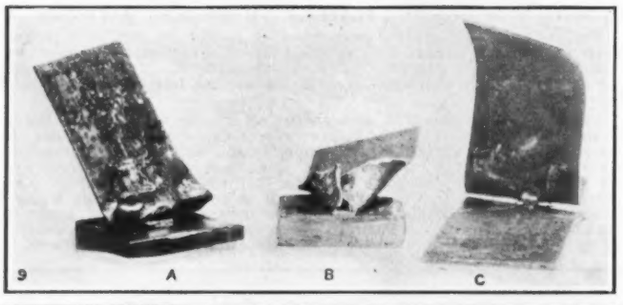
NEED OF AUTOMATIC WELDER

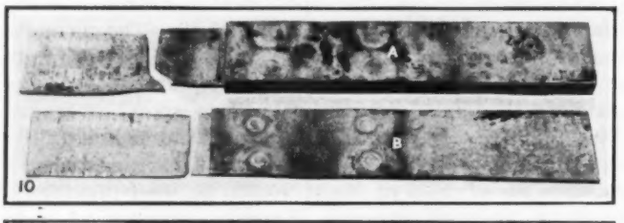
All of the machines referred to so far are manually operated or semi-automatic and the results depend to a large extent upon the judgment of the operator. The human element is a serious factor owing to the condition of labor today. Consequently, manufacturers are seeking an automatic welder that will make uniform welds and eliminate the human element. Such a machine has been developed and is shown in Figs. 14 and 15. The machine is designed to weld two pressed-steel channels to form an I-beam (Fig. 14). The machine is capable of welding two spots at a time between two pieces of ¼-in. material at the rate of sixty welds per minute. The welding current is controlled by an auto-transformer in the primary circuit.

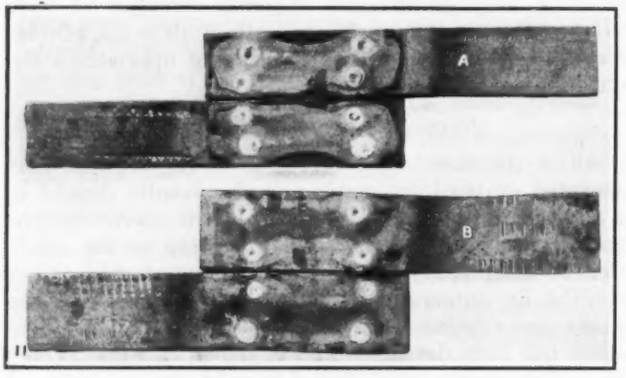
To determine the energy consumption for a day's run with spot welders such as used in obtaining the data in Table III, an integrating watt-hour meter was installed on a welder. The following results were obtained:











FIGS. 7 TO 11—SAMPLES OF SPOT WELDING

7*a*—Two pieces spot welded in four places failed in tension at 35,100 lb. due to insufficient welding pressure.

7*b*—Spot weld between No. 12 gage sheets held until parent metal tore.

8*a* and 8*b*—Plates sprung apart by chisels before weld failed.

9*a*—No. 14 gage sheet tore without welds on ¼-in. plate failing.

9*b*—Nature of metal union after distorting No. 14 gage sheet spot welded to ¼-in. material.

9*c*—No. 14 gage sheet tore without spot weld failing.

10*a* and 10*b*—Double- and single-lap joints spot welded at four points; joints separated at 25,500 and 25,050 lb. respectively; the joints in the former measured ⅜ in. in diameter and those in the latter ⅜ in.

11*a* and 11*b*—Joint welded at four spots having areas of 0.476 and 0.54 sq.in. respectively failed at 44,650 and 45,800 lb. tension respectively.

1,480 Welds of two pieces No. 18 gage sheet steel.
1,050 Welds of four pieces No. 18 gage and 1 piece ⅜-in. plate.
2,530 Welds in ten hours. Energy consumed, 42 kw.-hr.
680 Welds two pieces No. 18 gage sheet steel.
1,350 Welds four pieces No. 16 gage and one ⅜-in. plate.
545 Welds one piece No. 18 gage and one piece ¼-in. mild steel.
2,575 Welds in ten hours. Energy consumed, 35 kw.-hr.

The accuracy of integrating watt-hour meters for recording energy consumed by welders has been questioned by many engineers, who contend that over the short period involved the integrating watt-hour meter is sluggish and will not respond quickly enough. On the other hand, other engineers claim that the deceleration of the meter disk will compensate for the slow acceleration. No instruments were at hand whereby the accuracy of the integrating watt-hour meter used in collecting the foregoing data could be checked. A meter manufacturer states that integrating watt-hour meters register correctly all the energy that passes through them.

Owing to the nature of the material welded, the number of welds made in a ten-hour period is not large. It required three men to handle the work and one to operate the welder. To compare the composition of the weld with the parent metal, pieces of plate so welded were sent to the chemical laboratory for analysis. The following report was received:

1. From center of weld. Sulphur, 0.038; phosphorus, 0.020; manganese, 0.59; carbon, 0.08.
2. From edge of unwelded section but affected by heat: Sulphur, 0.042; phosphorus, 0.019; manganese, 0.60; carbon, 0.08.
3. From plate unaffected by heat: Sulphur, 0.040; phosphorus, 0.021; manganese, 0.58; carbon, 0.08.

TRANSFORMER CAPACITY NEEDED

On account of the low power factor on a spot welder, it is difficult to select transformers with proper capacity to care for welding equipment under all conditions of welding load. As manufacturers of welders give their machines a very liberal rating, it is safe to install transformers of an equal kva. rating where one welder is used. However, where more than one machine is used, it is not necessary to install transformers the kva. rating of which is equal to the total kva. rating of the welder. The load will vary from a fraction of a second to a few seconds, depending upon the nature of the work, giving a high diversity factor. Consequently the resultant load ranges between the total maximum load of the group of welders and the total rated capacity of the welders. To determine this factor a series of tests was run on six circuits carrying only a welder load. The total kva. of three welders on one circuit working on light stock but large and difficult to handle was 90 kva., whereas the average kva. was 41, giving a factor of 45.5 per cent. Another circuit carrying two welders, one being a 110-kva. semi-automatic welder working on easily handled heavy stock, showed an average high load of 73 kva., or a factor of 66.3 per cent. Another circuit having six welders with a total of 190 kva., all of which were working on light, easily handled stock, showed an average high load of 107 kva. and a factor of 56.4 per cent. These tests showed that where several welders are installed, the transformer kva. should be about 66 per cent of the total rated kva. of the welder.

Different types of contact electrodes used in spot welding are illustrated in Fig. 5 (*a*, *b*, *c* and *d*). To determine the proper electrode to use in welding material, No. 20 gage to No. 12 gage, a test was made by

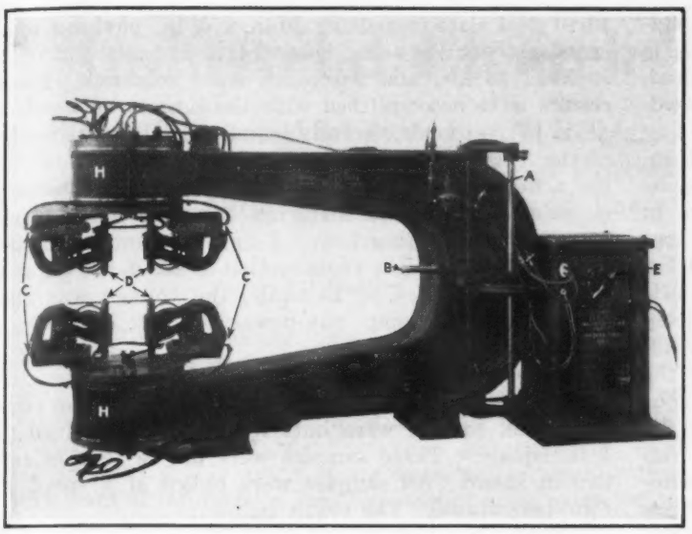


FIG. 12—SPOT WELDER ARRANGED TO IMPROVE POWER FACTOR

The machine shown in Fig. 12 has a 60-in. throat and is capable of welding two 24-gage sheets to two No. 8 gage sheets. Twelve welds per minute can be made on the heaviest stock, two pieces of No. 8, of strength to permit the prying apart of the pieces and pulling out the welded spots rather than breaking the weld. In both the upper and lower rotating heads, *H* is a 40-kva. welding transformer, the primaries being connected in parallel, the secondaries in series so that two spots must be made at the same time. The four welding points *D*, two upper and two lower, are so arranged that they can be adjusted for a distance of 3 to 8 in. between centers and can be drawn apart 5 in. The heads can be rotated to an angle of 93 by handle *B* to permit welding different angle on stock. The welding points are 1½ in. in diameter and are held in water-cooled holders. Air is applied to the four cylinders *C*, each operating an independent point to insure even contact on irregular surfaces. The air control valve *A* is so arranged as to give 300 to 700 lb. pressure between points *D* on the first step (depending on the thickness of the stock) and 1,200 lb. pressure on the second step for the final squeeze. The remote control switch is operated from the air control handle *A* mounted with the regulating transformer in case *E*. The regulating transformer supplies power to the welding transformers in eight equal steps from 65 per cent to full line voltage.

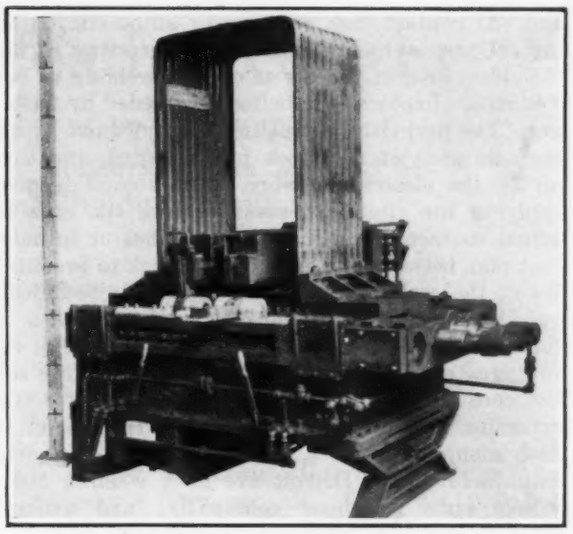


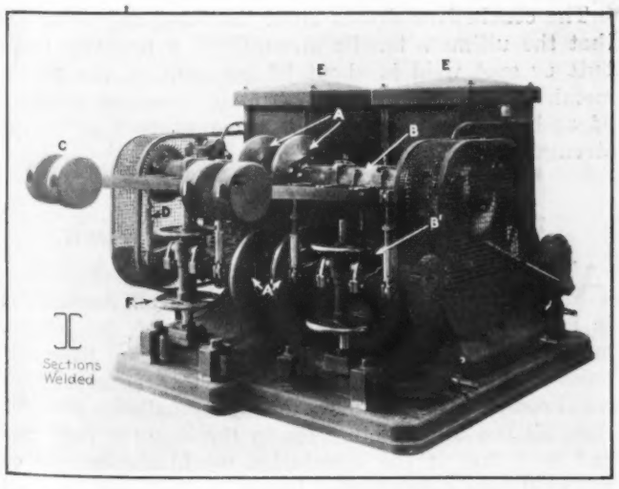
FIG. 13—LARGEST BUTT WELDER MADE TO DATE

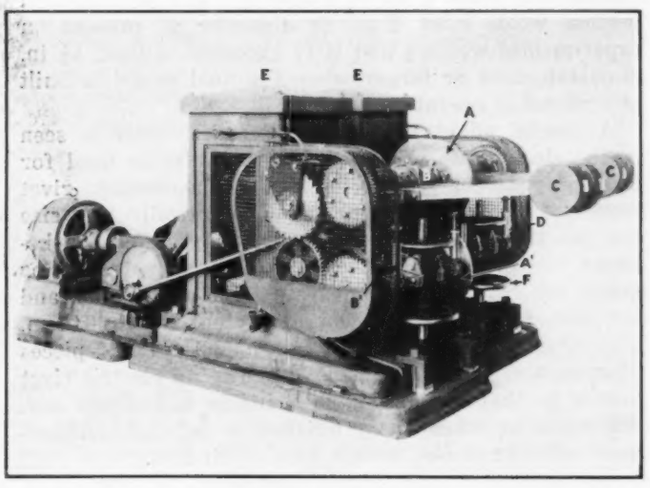
Fig. 13, installed in the main works of the Truscon Steel Company. It has welding capacity of 20 sq.in.; hydraulic pressure is used to force material together after obtaining the proper temperature for the welding.

taking two machines doing the same class of work, one machine being fitted with a contact electrode shown in Fig. 5*a*, the other machine being fitted with a contact electrode shown in 5*b*. At the end of one month's run, the saving on contact electrodes on a machine using the electrode shown in Fig. 5*a* was more than 50 per cent, and the production was speeded up more than 3 per cent owing to the time saved in dressing the points of the electrodes. Furthermore the welds made therewith were satisfactory.

Much development has been made within the last two years on seam welding. Until recently two sheets of No. 20 gage stock was the maximum limit for flat commercial work, while two sheets of No. 16 gage stock could be seamed by previously scarfing the edges. The limit in length of a seam weld was about 2 ft. Now, however, two ⅛-in. sheets can be welded and the length of sheets can be practically anything that can be procured in commerical stock. The seams can be made at a rate of 40 ft. per minute on two ⅛-in. sheets, and 20 ft. per minute on two ¼-in. sheets, without any scarfing or special preparation of the stock.

Butt welding may be subdivided into three classifications—namely, (1) upset welding, (2) flash welding,





FIGS. 14 AND 15—WELDER THAT ELIMINATES HUMAN ELEMENT

Will make 50 welds per minute, two at a time, between ¼-in. channels. The machine is made in two separate and distinct units, each making a weld and independent of each other. The welding transformers are in housing. Secondaries of the welding transformers are connected to bronze bearings *B* and *B'*. In these bearings runs a bronze shaft carrying the welding disk electrodes *A* and *A'*, which serve also as rolls to feed the stock. All parts carrying welding current are water cooled. Screws *F* raise or lower electrodes *A* and *A'*. Screws *D* (four in number) regulate the distance between *A* and *A'* so they will not short circuit. Pressures of 900 to 2,000 lb., depending upon the thickness of the stock, can be obtained by moving weights *C* (four in number) along the arms. The line contact between the disk electrodes *A* and *A'* and the work presents great resistance to the flow of current. As the metal becomes plastic the disk sinks into the work, slightly changing the line contact to a spot contact. The welds are uniform and satisfactory and the power factor is around 75 per cent. The welding disk can be adjusted to weld beams from 4 in. to 16 in. Welds can be made with 4 to 12 in. between centers. Variable speed motors control the speed of the material through the machine from 20 in. to 60 ft. per minute.

and (3) contact-flash welding, or automatic butt welding. Upset welding, it may be interesting to note, is the oldest or first process of electric welding to be used. For most purposes it is being superseded by flash welding. The first class of welding is carried out by butting the cold ends of the stock to be welded, and then applying the electric pressure. The second is made by applying the electric pressure before the ends are in actual contact and utilizing the flashes or minute arcs that play between the ends of the stock to produce heat. When the welding temperature is obtained, which is quickly, the current is shut off and the ends are quickly forced together to complete the weld. Among the advantages of flash welding over upset welding are the low consumption of energy required, less upsetting or extrusion of stock, burned metal is thrown off in the flash along with gases, greater production (some rim manufacturers in Detroit are flash welding 300 automobile rims per hour constantly) and generally a stronger weld. Some recent applications of flash welding involve welding of auto truck wheels rolled up from I-beams with a cross-section of 10 in. x $\frac{5}{8}$ in., train coupler links for English railroads, drop-forged hubs for disk wheels for Cadillac, Studebaker and Dodge cars, fliers for looms, steel-welded wheels for Ford cars and duralumin for a multiplicity of uses.

CONTACT-FLASH WELDING A NEW DEVELOPMENT

Contact-flash welding is a new development to be made available on the market shortly. In some respects it is very similar to percussion welding but is radically different in others. The weld is made almost instantly. The nearby metal is not heated, and a weld can be handled immediately after being removed from the welder without burning the hand. The percussion weld was originally made by power derived from the discharge of a condenser, but is now being made by adding the "kick" from a direct-current coil, thus limiting the ability to obtain power in large quantities. Contact-flash welding is accomplished with power from a transformer, thus making it possible to obtain power in any quantity. The percussion process will weld successfully stock $\frac{1}{2}$ in. in diameter. The contact-flash process welds stock 1 in. in diameter at present on experimental welders and it is expected to weld $1\frac{1}{2}$ in. diameter stock or larger when the final model is built and placed in operation.

A special adaptation of the electric welder is seen in the electric pipe heater, which can also be used for heating rods, bars or billets; also the electric rivet heater, which will heat rivets of practically any size for practically all purposes. The only difference between the processes is that the pipes, bars, billets or rivets are in one continuous piece instead of two, and are heated by the actual flow of current through them. The rivet heaters are quick, clean and reliable pieces of apparatus. One great advantage of an electric rivet heater is that it can be used inside a Pullman car, stateroom or other nicely finished or painted compartment without smoke, grime, soot or cinders.

BUTT-WELD TESTS

Results of tests on butt welding as well as tests from the weld after making may be of interest. In butt welding a bar of iron with 1 sq.in. cross-section, 218 volt and 210 amp. were required with a power demand of 39.5 kw. and a power factor of 86 per cent. The average of a number of flash welding tests on S.A.E. 10-10 steel plate measuring 30 in. x $\frac{1}{8}$ in., having a total cross-section of $5\frac{5}{8}$ sq.in., showed that 222 volt, 432 amp., 93 kva., 84 kw. and 9 seconds were required. These results were accomplished with the largest butt welder (Fig. 15) yet made, recently installed in the main works of the Truscon Steel Company, Youngstown, Ohio. It has a welding capacity of 20 sq.in. Hydraulic pressure is used to force the materials together after being brought to a welding heat. Using the same machines to weld steel having a cross-section of 28 in. x $\frac{1}{2}$ in. or a cross-sectional area of 14 sq.in., the voltage was 218, the current 1,220 amp., the power 265 kva. or 259 kw., and the time 26 seconds.

To compare the tensile and the shearing strengths of butt welds with the original parent metal, five samples, 2 in. square, were butt welded and machined to 1 in. square. Three samples were put in tension and two in shear. All samples were pulled at a speed of $\frac{1}{8}$ in. per minute. The result follows:

	Sample	Nature of Failure	Stress at Failure, Lb.
In tension	1	Failed in weld	48,000
	2	Failed in weld	52,300
	3	Failed back of weld	50,100
In shear	4	Failed in weld	51,500
	5	Failed in weld	50,300

These tests indicate that the ultimate shearing strength of such a weld closely approaches the ultimate tensile strength.

Pieces of soft steel $\frac{1}{8}$ in. thick and 5 in. wide, with an ultimate tensile strength of 56,150 lb., were butt welded and pulled with the following results:

Test No.	Manner of Failure	Stress (lb.)	Per Cent of Ultimate
1	$\frac{1}{2}$ in. plate and $\frac{1}{2}$ in. weld	51,000	91
2	In plate just back of weld	52,000	93
3	In plate just back of weld	53,400	95
4	In plate just back of weld	52,000	93
5	In plate just back of weld	46,100	82
6	In plate just back of weld	51,900	93

The conclusions drawn from the foregoing tests are that the ultimate tensile strength of a properly made butt or spot weld is about 93 per cent of the parent metal, in general, and the ultimate shearing strength of such a weld is about the same proportion of the strength of the parent metal.

British Electrical Research Work

AT THE recent annual meeting of the British Electrical and Allied Industries Research Association in London Sir Frank Heath, secretary of the government Department of Scientific and Industrial Research, pointed out that in the United States three great electrical companies spend more money annually on research than all the other industries in the country combined and said that if the association would concentrate on research into fundamental issues, he believed England would pass the United States in development within a few years. Sir Philip Nash, president of the association, spoke along the same lines and used the development of insulating material as an example of the far-reaching effects of scientific and thorough research on commercial practices and on the development of engineering equipment of great value to industry.

Industrial Electric Heating Survey

Edison Territorial Study in Boston Reveals Large Market for Service Offered by Diversified Manufacturing and Processing Concerns—The Method of Compiling Survey Data and Their Load-Building Significance

By J. L. FADEN

Industrial Heating Engineer, Edison Electric Illuminating Company of Boston

TO OBTAIN a definite knowledge of the existing, potential and deferred industrial heating service market in its territory, the Edison Electric Illuminating Company of Boston, Mass., recently organized an intensive survey of manufacturing and business establishments within reach of its lines, and accumulated a mass of information that has been of great value to all interested in extending this class of central-station service in eastern Massachusetts. It is believed that this is the first systematic survey of the kind undertaken by a central station. The work was begun some months ago and is still going forward.

As the survey developed, the opportunities for adding industrial electric heating service materialized so rapidly that it was decided to carry the investigation along with these applications instead of waiting for the entire territory of 700 square miles to be covered before engaging in active load building. Analyses of the establishments of 134 principal industrial customers show a present connected power and lighting load totaling 17,500 kw. in these installations, with a present connected electric heating load of about 1,500 kw., a "potential" or present economically warranted connected electric heating load of 12,500 kw., and a "deferred" connected load of about 33,000 kw. This last load represents those processes that it is not yet economical to electrify, either from a comparative cost basis or from the fact that suitable electrical apparatus has still to be developed for the service.

The survey included the existing uses of industrial heating, from high-temperature applications down to low-temperature applications exclusive of commercial electric cooking.

To obtain a list of industrial plants to canvass, a card file was prepared, using information obtained from a directory of manufacturers and from the Edison company's own records. This file included plants in which it was known that heating processes were used, or where their existence was suspected. The cards were filed by towns until the survey was completed, when they were transferred to an alphabetical file.

After the survey had been under way for about a month, a list of manufacturing establishments, classified by processes, was prepared, using as a basis information already obtained. This list was used as a guide in selecting additional plants to call upon and for eliminating certain lines of business on the original directory and company file list.

This list enumerates ten manufacturing businesses that were prospective or present users of electricity in paraffin and glue heating, thirty-five metal-working classes, twelve chemical manufacturing businesses, five types of printing establishments, and seven miscellaneous classes of plants either using electric heat or potentially available as consumers of such service.

At the beginning of the survey several plants were visited, embracing several lines of manufacturing where it was questionable whether or not uses for electric heat could be found. Where a particular plant in a

TABLE I—POSSIBLE USERS OF ELECTRIC HEAT CLASSIFIED ACCORDING TO HEATING PROCESSES

1. Glue and Paraffin Heating.
Bookbinders.

MANUFACTURERS OF:
Paper boxes.
Wooden boxes.
Pianos and organs.
Wooden furniture.
Truck and auto bodies.
Waxed paper.
Wooden patterns.
Cabinets.
Toys, paper and wooden novelties.
Apparatus used: Glue pots and spreaders, paraffin spreaders, drying and baking ovens.

2. Metal Working.
Shipyards.
Structural steel and iron works.
Street railway shops.
Railroad shops.

MANUFACTURERS OF:
Iron wire and nails.
Copper and brass wire.
Boilers.
Insulated cable.
Plumbing fixtures.
Pipe.
Pipe fittings, valves and gages.
Non-ferrous castings.
Non-ferrous alloys.
Ferrous castings.
Automobiles, truck and accessories.
Textile machinery.
Paper and pulp mill machinery.
Automatic and special process machinery.
Hand tools and bench machinery.
Clocks, timing devices and electric signal equipment.
Gears.
Sheet metal work.
Watches.
Alloys.
Vitreous enameled ware.
Woodworking machinery.
Conveyor and hoisting machinery.
Automatic screw machine products.
Machine tools.
Electric control equipment.
Electric motors.
Copper kettles and fittings.
Forgings.
Metal furniture.
Weighing devices.
Apparatus used: Heat-treating furnaces, baking and japanning ovens, nonferrous melting furnaces, steel furnaces, vitreous enameling furnaces, soft metal melting pots, soldering irons, space heaters, rivet heaters.

3. Chemical.

MANUFACTURERS OF:
Pharmaceuticals.
Paint and varnish.
Gums and dextrines.
Roofing, building and waterproof paper.
Ink, paste and mucilage.
Rubber goods.
Storage batteries.
Confectionery.
Electric insulation.
Abrasive wheels.
Phonograph records.
Miscellaneous chemicals.
Apparatus used: Steelclad and conduction heaters, drying and baking ovens, vacuum driers, cooking and heating appliances, low-temperature melting pots and tanks.

4. Printing.
Newspapers and periodicals.
Job shops.
Electrotypers.
Engravers.
Printers of tags and labels.
Apparatus used: Linotype pots, radiant ink driers, steel-clad and conduction heaters, wax melting pots, stereotype and remelting pots.

5. Miscellaneous.
Automobile refinishing plants.

MANUFACTURERS OF:
Hard fiber.
Shoes.
Decorated chinaware.
Enameled fishlines.
False teeth and bridge work.
Radio apparatus.
Apparatus used: Drying ovens, steel-clad and conduction heaters, cartridge heaters, muffle furnaces, space heaters, high-temperature laboratory furnaces, soldering irons.

FORM J

Industrial Heating Survey

THE EDISON ELECTRIC ILLUMINATING CO. OF BOSTON

Summary Sheet—Electrical Capacities of Various Kinds of Load Encountered

Plant	Location	Heating						Power			
		Present		Potential		*Deferred		Present		Potential	
		Kw	Kw.-Hr	Kw	Kw.-Hr	Kw	Kw.-Hr	Kw	Kw.-Hr	Kw	Kw.-Hr

* Not economical or apparatus not developed

FORM C

Industrial Heating Survey

THE EDISON ELECTRIC ILLUMINATING CO. OF BOSTON

Heat Treating Furnace Data

1 Metal _____

2 Process
(a) Temp. Range _____

3. Fuel
(a) Type _____
(b) Unit Cost _____
(c) Consumption, tie in with (4) _____

4. Production
(a) Pounds per hour _____
(b) Pounds per day _____
(c) Average weight per heat _____
(d) Maximum weight per heat _____
(e) Average time per heat _____

5 Present Equipment
(a) Furnace Chamber Inside Dimension _____
(b) Maximum Size of Charge _____
(c) Number of Units _____

6. Estimated K.W _____ K.W.H. (Yearly) _____

7 Remarks _____

Survey by _____ Date _____

FORM D

Industrial Heating Survey

THE EDISON ELECTRIC ILLUMINATING CO. OF BOSTON

Oven Data

1 Material _____

2. Process _____
(a) Temp. Range _____

3 Fuel
(a) Type _____
(b) Unit Cost _____
(c) Consumption, tie in with (4) _____

4. Production
(a) Pounds per hour _____
(b) Pounds per day _____
(c) Average weight per bake _____
(d) Maximum weight per bake _____
(e) Average time per bake _____

5 Present Equipment
(a) Type _____
(b) Oven Inside Dimension _____
(c) Number of Units _____

6. Estimated K.W. _____ K.W.H. _____

7 Remarks _____

Survey by _____ Date _____

FORM E

Industrial Heating Survey

THE EDISON ELECTRIC ILLUMINATING CO. OF BOSTON

Miscellaneous Data

1 Application _____

2 Process _____
(a) Temp. Range _____

3 Fuel
(a) Type _____
(b) Unit Cost, tie in with (4) _____
(c) Consumption _____

4 Production (tabulate to suit conditions) _____

5 Present Equipment (tabulate to suit conditions) _____

6 Estimated K.W _____ K.W.H _____

7 Remarks _____

Survey by _____ Date _____

FORM B

Industrial Heating Survey

THE EDISON ELECTRIC ILLUMINATING CO. OF BOSTON

Melting Furnace Data

1 Metal _____

2 Fuel
(a) Type _____
(b) Unit Cost _____
(c) Consumption, tie in with (3) _____

3. Production
(a) Pounds per hour _____
(b) Pounds per day _____
(c) Average weight per heat _____
(d) Maximum weight per heat _____
(e) Average time per heat _____

4 Estimated K.W _____ K.W.H. (Yearly) _____
(Include No. of Units)

5. Remarks _____

Survey by _____ Date _____

FORM F

Industrial Heating Survey

Data used as basis for charts Figs. 3, 4 and 5

	Industrial Heating Load			
	Potential		Deferred	
	K.W	K.W.H (Annual)	K.W	K.W.H (Annual)
Brass Melting	375	560,000		
Annealing	200	540,000		
Normalizing	200	540,000		
Lead Hardening	90	178,000		
Misc. Hardening	33	36,400		
Oil Tempering	90	80,000		
Japanning	30	40,000		
Metal Pattern Heating	31	54,500		
Core Baking				
Brass Foundry	25	25,000		
Iron Foundry	200	398,000		
Gray Iron Melting			2,400	6,050,000
White Iron Melting			1,600	3,175,000
Forging			420	1,340,000
Malleabilizing			300	2,000,000
Iron Foundry (Core Baking)			200	398,000
Steel Scrap Melting			200	380,000
Galvanizing			150	320,000
Total	1,274	2,351,900	5,270	13,663,000

FORM A

Data Sheet for Industrial Heating Survey

THE EDISON ELECTRIC ILLUMINATING CO. OF BOSTON

1 Date of Survey _____

2 Company Name _____

3 Address _____

4 Person Interviewed _____

5 Principal Product Manufactured _____

6. List of Processes to which Electric Heat could be applied _____

7 Special Data Sheets _____ attached covering (6) _____

	K.W	Yearly K.W.H.
8 Present Electric Heating Load		

9. Summary of attached data sheets _____

10 Present Motor Load _____

11 Power Supply a.c. _____ voltage _____ phase _____

12 Any new manufacturing process contemplated for future requiring electric heat _____

13 Remarks _____

Survey by _____

FORM K

Potential Electric Heat Users

Name of Concern	Classification							
	A	B	C	D	F	F	G	H	I

FORMS USED BY EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON TO COLLECT INDUSTRIAL HEATING DATA

given industry was found to offer no prospects for the use of electric heating, a note of this was made and similar plants were avoided.

To put the survey on as systematic a basis as possible, the various heating processes were classified into nine division as follows:

A. Steel-melting furnaces.
B. Non-ferrous melting furnaces.
1. Brass melting.
2. Aluminum.
3. Alloys of lead and tin.
4. Nickel.

C. Heat-treating furnaces operating above 1,000 deg. F.
1. Annealing.
2. Hardening.
3. Carburizing.
4. Normalizing.
5. Vitreous enameling.

D. Ovens operating up to 1,000 deg. F.
1. Japanning.
2. Paint drying.
3. Core baking.
4. Tempering.
5. Miscellaneous baking.
6. Miscellaneous drying.

E. Bread baking and commercial cooking.
F. Welding equipment.
G. Unit applications.
1. Laundry machinery.
2. Shoe machinery.
3. Glue pots.
4. Wax and paraffin pots.
5. Pitch melting.
6. Low-temperature melting pots.
7. Water heating.
8. Miscellaneous.

H. Rivet heaters.
I. Galvanizing and sherardizing.

The field data were prepared on a series of six classified sheets available for each plant covered. On the first of these sheets, all of which were letter size, was recorded a summary of the data assembled for that particular plant, and showing the present and prospective heating load of the establishment, potential and

Name ..... Town .....
Address ..... Employees .....
Product ....
Person interested .....
Present equipment .....

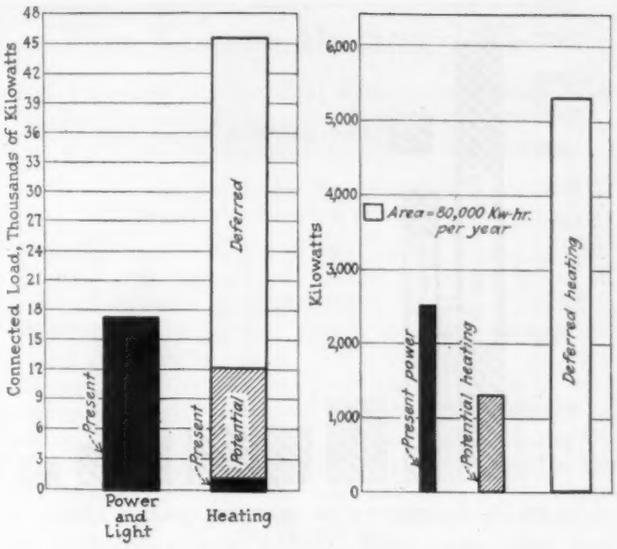
Survey made
Refer to file report

FIG. 1—INDEX CARD REFERS TO REPORT ON INDIVIDUAL PLANT

deferred, the motor load, class of product manufactured, power supply conditions, person interviewed, and list of processes to which electric heat could be applied as listed on an attached sheet giving these details.

In this typical case, illustrated here on form "A," the tool manufacturer's present connected motor load is 2,500 kw., and his annual energy consumption for power is 2,500,000 kw.-hr. On another sheet, form "F," are tabulated the potential and deferred industrial electric heating load of the plant, which shows that in this establishment ten economic electric heating applications totaling 1,274 kw. and using 2,351,000 kw.-hr. per year should be at once added to the service, and that seven other heating applications still challenge the electrical industry in this concern, with a deferred total connected additional load of 5,270 kw. and a corresponding annual energy consumption of 13,663,000 kw.-hr. It is significant that the economically justified electric heating load that should be taken on as soon as possible in this plant will consume more energy than the present total power service of the establishment, and that the use of the connected load per year is 1.8 times as great for the heating installation as for the motors.

The other field data sheets showed the fundamental



POSSIBILITIES OF ELECTRIC HEATING APPLICATIONS

Fig. 2 (at left)—Potential heating load is nearly two-thirds of present power and lighting load in 134 leading industrial plants.

Fig. 3 (at right)—Economically justified heating load and deferred heating load compared with present power and lighting load in tool plant.

cost, product and process information for the particular plant according to its use of melting furnaces, heat-treating furnaces, ovens and miscellaneous equipment. These sheets are shown here as forms "B," "C," "D" and "E."

These detailed data sheets were filled out in all cases where the field information obtained was complete enough to warrant it. Where the heating processes in a particular plant were not very extensive, the detail sheets were not used and all the data were placed on the summary sheet. In some cases where the heating processes were extremely limited, the information

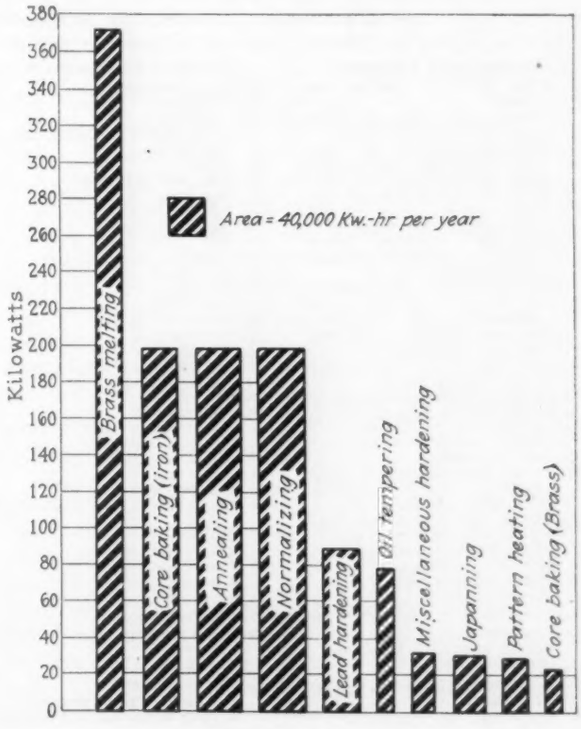


FIG. 4—COMPOSITION OF POTENTIAL HEATING LOAD IN TOOL PLANT

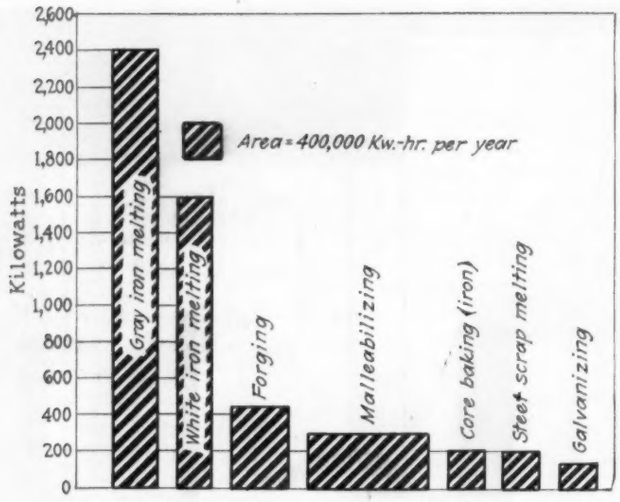


FIG. 5—COMPOSITION OF DEFERRED HEATING LOAD IN TOOL PLANT

obtained was simply noted on a card and placed in the file.

In some of the plants analyzed, graphic charts were drawn to show in rectangular areas proportional to annual energy requirements the present power, potential and deferred heating loads of the plant, the subdivided values of the potential electric heating load classified by applications and the approximated values in annual energy requirements of the deferred heating load. This last was a more approximate estimate than the potential electric heating business charted, but was designed to picture the field of future activity for the industrial electric heating engineer, be he a staff man for a manufacturer of electrical apparatus or a central-station representative. Three of these charts, Figs. 3, 4 and 5, are shown here. They are based on the analysis of the tool-manufacturing plant.

In some of the large plants visited the heating processes were very complex and extensive, and in these cases not only were the data sheets filled out covering the various processes, but process charts were prepared, listing graphically the run of the material through the various heating operations from the raw material to the finished product.

Fig. 6 shows a process chart covering the manufacture of wrench parts. The raw material is listed at the top of the chart and inclosed in circles. The various heating processes entering into the manufacture of the wrench are indicated on the right and inclosed in rectangles. Mechanical processes are indicated on the left, and the finished product is shown at the bottom inclosed in a circle. It will be noted that one or more heating operations are applied to the wrench in the process of its manufacture. Four million pounds of steel are manufactured yearly into movable jaws. The jaw is first fashioned by forging. It is then trimmed and moved to the annealing process, where the strains set up by forging are removed, and is then passed through the normalizing process, where the grain structure of the steel is refined. Next it passes through the hardening process and thence to the tempering. Next the parts are washed in an alkali bath to remove the oil brought over from the tempering bath. After this the jaw is moved to the assembling department, where it is placed in its proper position in the wrench. In this particular plant the forging, annealing and normalizing furnaces are now heated by fuel oil, the hardening and tempering processes are heated by city gas, and the washing tank is also heated by city gas.

This figure shows how important and varied the heating processes are that enter into the manufacture of tools.

Since the start of the survey 605 industrial plants have been visited and data secured on industrial heating processes.

TABLE II—PARTIAL LIST OF PLANTS COVERED BY INDUSTRIAL HEATING SURVEY

Number and Product	Number and Product	Number and Product	Number and Product
1. Pipe fittings, valves and tools.	32. Iron castings.	69. Boilers.	101. Automatic scales and machinery.
2. Fans, blowers, heaters, ventilators and driers.	33. Eyeglass cases, jewelry boxes.	70. Watchmakers' lathes.	102. Galvanizing iron.
3. Hack saws.	34. Orthopedic and surgical appliances.	71. Paper cans and tubes.	103. Refrigerators.
4. Wood-working machinery and induction motors.	35. Boats.	72. Bench lathes.	104. Automobile springs.
5. Buttonhole machinery.	36. Catalog printing.	73. Watch tools.	105. Special machinery.
6. Brass goods.	37. Machine parts.	74. Cutting dies.	106. Screw machine products.
7. Printing and publishing.	38. Publications.	75. Small machinery and tools.	107. Clocks.
8. Printing presses, gears, slitting and rewinding machinery.	39. Confectionery.	76. Laundry machines.	108. Power plant construction.
9. Wrenches and pipe cutters.	40. Tin containers.	77. Heating and cooking apparatus.	109. Textile machinery.
10. Automobile painting and enameling.	41. Custom furniture.	78. Confectioners' machinery.	110. Iron castings, steel pipe, etc.
11. Electric motors and signaling systems.	42. Machinery.	79. Crockery.	111. Fishing lines.
12. Machinery.	43. Pianos.	80. Steam boilers and tanks.	112. Metallic packing.
13. Metal products.	44. Furniture.	81. Iron castings.	113. Machine tools.
14. Steel castings.	45. Gasoline gages.	82. Rotary plunger pumps, auto asphalt tar distributors and clutches.	114. Radio apparatus.
15. Newspapers.	46. Newspaper.	83. Soda fountains.	115. Lifting jacks.
16. Japanning.	47. Printing.	84. Receivers and condensers.	116. Brass foundry.
17. Gages, safety valves, etc.	48. Structural and ornamental iron work.	85. Smelting and refining copper.	117. Tool and stamping company.
18. Confectionery.	49. Tin cans.	86. Car wheels.	118. Optical goods and sun glasses.
19. Brass and aluminum castings.	50. Newspaper.	87. Clocks.	119. Zincs and coppers for wet batteries and metal specialties.
20. Medicinal products.	51. Sash, doors and windows.	88. Boilers, tanks.	120. Brass castings.
21. Brass and aluminum castings and auto accessories.	52. Confectionery.	89. Ornamental iron and bronze.	121. Ophthalmic lenses.
22. Electric insulation.	53. Tobacco goods.	90. Hot-rolled and cold-drawn steel.	122. Conveying machinery.
23. Grinding wheels.	54. Printing.	91. Cans.	123. Plumbing supplies.
24. Plumbing supplies.	55. Confectionery.	92. Machine screws and washers.	124. Metal specialties and spinning.
25. Machine parts.	56. Battery making and charging.	93. Linotypes.	125. Japanning, repairing and supplying.
26. Fasteners, buttons and badges.	57. Furniture.	94. Satin white and rosin size for paper mills.	126. Aluminum castings.
27. Screw machine products.	58. Confectionery.	95. Laundry machines, lab supplies.	127. Electric railway light and power specialties.
28. Stills.	59. Confectionery.	96. Woodwork and auto bodies.	128. Rivets.
29. Platers, japanners, brass finishers.	60. Confectionery.	97. Fiber products, cans, trucks and boxes.	129. Vitreous enamel.
30. Printing.	61. Electrotypes.	98. Publishing and printing.	130. Bakelite moldings.
31. Clocks.	62. Newspaper.	99. Machine tools.	131. Bakelite moldings.
	63. Bookbinders and paper rulers.	100. Electrotypes.	132. Spring beds.
	64. Newspaper.		133. Surgical instruments.
	65. Confectionery.		134. Copper and brass tubing.
	66. Surgical instruments.		
	67. Gages and special tools.		
	68. Iron.		

As the survey progressed the results were tabulated under two classifications. In the first, the names of all the plants surveyed were arranged alphabetically and the various heating processes found were listed according to the nine classifications previously mentioned. This list gave us such information as which are the concerns that melt brass, for instance, or use glue pots, or melt type metal, etc. The second classification, form "J," was a summary of the electrical capacities of the various classes of load encountered. Form "K" shows a further method of summarizing the different potential heat uses, classified according to forms "A," "B," "C," etc.

These surveys have been of great value in the development of new business along industrial heating lines. In plants where it was found that potential business existed, industrial heating reports were prepared. These reports were submitted to the management of the company interested, and outlined where savings could be made by using electric heat in place of some other form of fuel.

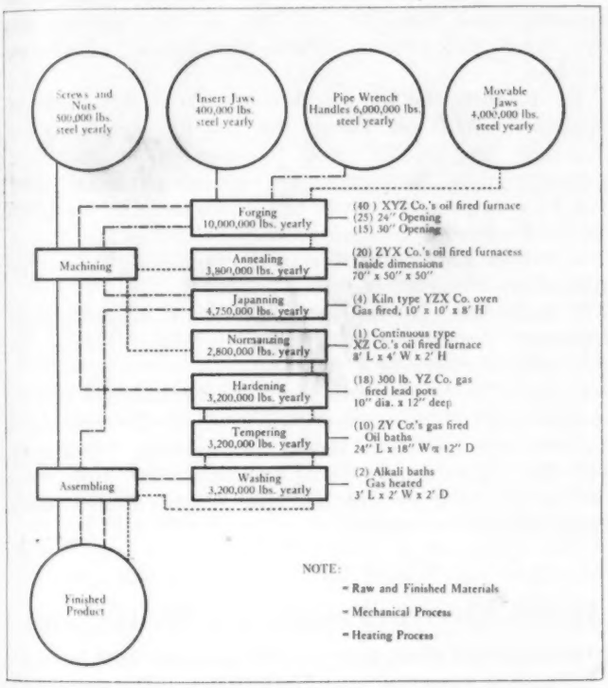

Screws and Nuts 500,000 lbs. steel yearly
Insert Jaws 400,000 lbs. steel yearly
Pipe Wrench Handles 6,000,000 lbs. steel yearly
Movable Jaws 4,000,000 lbs. steel yearly
Forging 10,000,000 lbs. yearly
(40) XYZ Co.'s oil fired furnace
(25) 24" Opening
(15) 30" Opening
Machining
Annealing 3,800,000 lbs. yearly
(20) ZYX Co.'s oil fired furnacess Inside dimensions 70" x 50" x 50"
Japanning 4,750,000 lbs. yearly
(4) Kiln type YZX Co. oven Gas fired, 10' x 10' x 8' H
Normanizing 2,800,000 lbs. yearly
(1) Continuous type XZ Co.'s oil fired furnace 8' L x 4' W x 2' H
Hardening 3,200,000 lbs. yearly
(18) 300 lb. YZ Co. gas fired lead pots 10" dia. x 12" deep
Tempering 3,200,000 lbs. yearly
(10) ZY Co's gas fired Oil baths 24" L x 18" W x 12" D
Assembling
Washing 3,200,000 lbs. yearly
(2) Alkali baths Gas heated 3' L x 2' W x 2' D
Finished Product
NOTE:
= Raw and Finished Materials
= Mechanical Process
= Heating Process

FIG. 6—CHART OF HEATING AND MECHANICAL PROCESSING IN WRENCH MANUFACTURE. PRESENT HEATING METHODS SHOWN AT RIGHT

Swedish Water-Power Development

THE United States Trade Commissioner at Stockholm calls attention to the development of water power in Sweden as described in the recently published annual report of the Swedish Power Plant Association for 1923.

During the year 1923, 26,500 hp. in privately owned plants and 720 hp. in a government plant were placed in operation and 47,500 hp. in private developments and 30,000 hp. in government developments were still under construction. Additional projects totaling 17,500 hp. were also started during the year. At the end of 1923 the total installed water power was approximately 1,350,000 hp.

Fire Losses During 1923

First Increase in Electrical Fire Losses Since 1918 —An Analysis of National Fire Underwriters' Records—Responsibility of the Industry

BY REGINALD TRAUTSCHOLD
The Society for Electrical Development, Inc.

THE total fire losses in the United States for the year 1923 are placed by the National Board of Fire Underwriters at $535,372,782. Of this staggering amount, fires of reputed electrical origin contributed $14,091,789—approximately 2.6 per cent of the total. Although this figure does not appear to be a very large percentage, viewed as a proportion it should be looked upon with anxiety by all interested in the extension of electric service. The record marks the first time since 1918 that there has been any increase in losses from fires of electrical origin. Fortunately, the 1923 losses were still not much more than two-thirds as great as those that occurred in 1918, but they entailed nevertheless a loss of thirteen cents for every man, woman and child in the country. In 1918 the per capita loss was twenty cents.

The increase in the fire toll over the previously high record of 1922 was 5.69 per cent. Non-electrical fire losses increased 5.37 per cent and electrical fire losses increased 18.23 per cent. In view of the fact that the utilization of electric service for all purposes was not more than 16.42 per cent greater in 1923 than in the year previous, the increase in electrical fire losses was considerably greater than the increase in use of electric service.

It will not suffice for the electrical industry to deny all responsibility and to belittle the so-called electric fire hazard by pointing to the small percentage of the total losses actually occasioned by fires of electrical origin, or to content itself with attributing the increase in electrical fire losses to carelessness, disregard of ordinary precautionary measures and abuse of electric service by the public, even if such arraignment is true, as it unquestionably is.

The electrical industry has a responsibility it cannot shirk. It deals with the form of energy that is distinguished by the characteristic of being the safest of all forms of energy that can be used for light, heat and power when properly controlled and regulated. If the public cannot be trusted to make proper use of the energy as supplied, provisions must be devised whereby the possibilities of service abuse are reduced to a minimum, if not entirely eliminated. This need is emphasized not so much by the 18.23 per cent increase in electrical fire losses as by the fact that such increase has been very far from uniform. It was much higher in many localities.

FLUCTUATIONS IN ELECTRICAL FIRE LOSSES

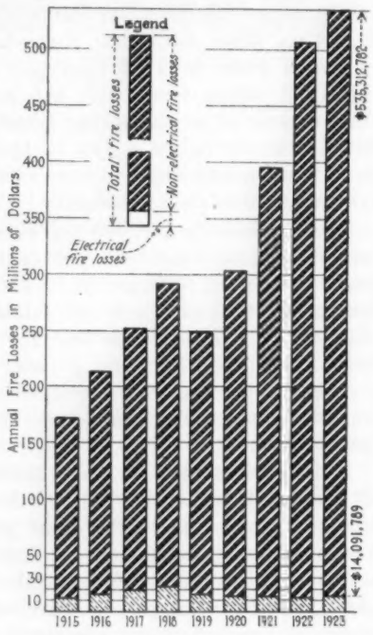
A study of the various state records show that in substantially half the states electrical fire losses increased during 1923 and in half the states they decreased. The average increase in the unfortunate states was aproximately 40 per cent and the average increase for the ten states suffering most was 280 per cent. An 18.23 per cent increase might be accepted without serious results, but certainly a 280 per cent increase in ten states, representing nearly 11 per cent of the population of the country and 9.6 per cent of

the residences wired for electric service, cannot be passed over without comment.

In the ten states where electrical fire losses showed the greatest proportional decrease, representing about 12 per cent of the inhabitants and 9.3 per cent of the wired residences, the average decrease in electrical fire losses was more than 50 per cent.

There is a vast difference between a 50 per cent decrease in electrical fire losses and an increase of 280 per cent, and there should be some apparent reason for the difference. Substantially a quarter of the nation's population is affected and almost a third of the country in area, so local conditions of extenuating character cannot well be advanced in way of explanation. A fault or a weakness should be discernible.

If we compare the progress made in electrical service development in the sections of the country where electrical fire losses increased during 1923 with that where the losses decreased, some very pertinent deductions can be made with reasonable assurance of their being dependable. An examination of the state records where electrical fire losses increased show, first, that in the entire list there is only one state in which the use of electric service has become so general as to be considered almost universal. The one exception, furthermore, does not rank among the ten states showing the greatest proportional increase in electrical fire losses, but comes twenty-second in the list. Consequently it is apparent that the increases in electrical fire losses occurred almost entirely in communities where the utilization of electric service had not previously been very general. In fact, the utilization of electric service in the states where the electrical fire losses for 1923 showed a decrease was in that year about 17½ per cent more general than in the states where the losses increased.



COMPARISON OF ELECTRICAL AND NON-ELECTRICAL FIRE LOSSES

Second, the proportional increase in utilization of electric service was more marked in the states where edectrical fire losses increased than in those where they decreased. In other words, the increases occurred largely in territories where electric service was more of a novelty, although the growth in electrical service development was also pronounced in the states where electrical fire losses decreased. Expressed in percentage as a measure of electrical service development growth during 1923, the rate of growth in the states where electrical fire losses decreased was substantially 85 per cent of that where such proportional losses increased.

Where the utilization of electric energy was and had been most general, electrical fire losses decreased not only proportionally but actually. On the other hand, where the utilization of electric service was more recent, electrical fire losses increased. This would indicate that familiarity with electric service engendered greater care in its use and that ignorance is largely responsible for electrical fires, and it follows that the problem confronting the electrical industry is to teach new users of electric service how to make proper use of the service.

Increased utilization of electric service in communities already making considerable use of the service, as in the territories where electric fires generally decreased in 1923, is dependent usually on the provision of more adequate facilities for electric service utilization. At first the novice in electric service utilization is apt to be content with much less adequate facilities, but as he becomes more familiar with its use he improves his equipment and greatly lessens the danger of electric fire loss.

To protect the new customer from his lack of familiarity with electric service and its proper utilization and the public from the burden of increased property losses from fires of electrical origin, whether due to carelessness, abuse or ignorance, the electrical industry assumes two major responsibilities:

1. Dissemination of information regarding the proper utilization of electric service.

2. Insistence, so far as possible, on adequate and approved electric wiring and suitable devices for rendering the service.

If these two relatively simple undertakings can be energetically and consistently directed by all branches of the industry, no costly lesson in acquiring familiarity with the safest known form of energy for light, heat and power need be entailed and electrical fire losses should steadily decrease.

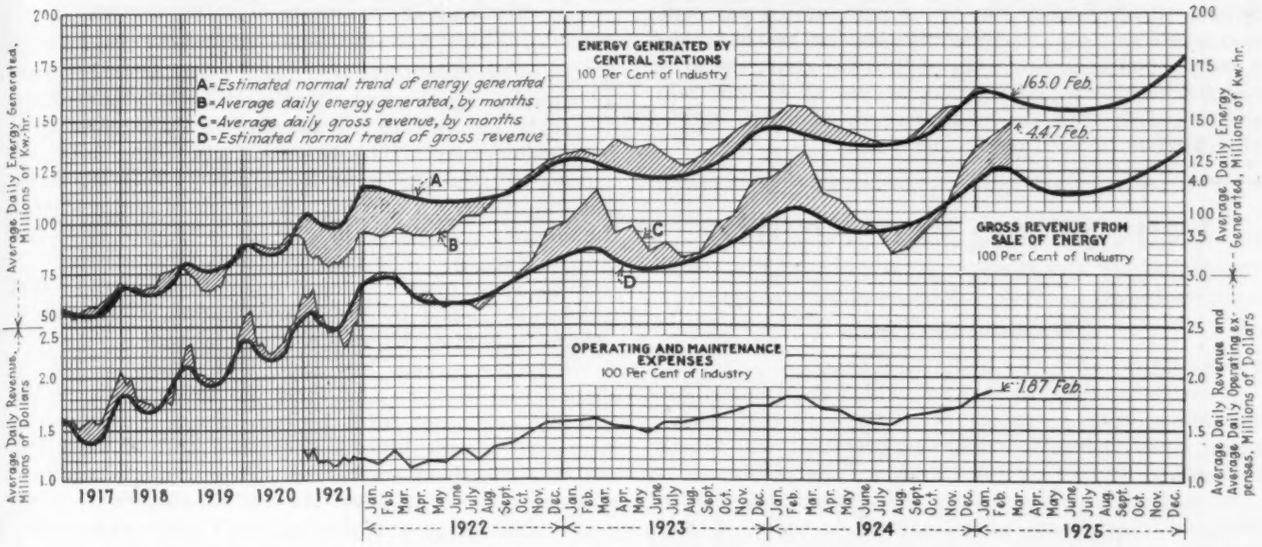
Hydro-Electric Progress in Switzerland

SWITZERLAND'S hydro-electric plants now have an installed capacity of 1,570,379 hp., with an output during 1923 of 3,063,000,000 kw.-hr., according to a recent report of the Swiss Water Economics Association. This output was divided as to use in this way: Lighting, power and heating, 1,682,000,000 kw.-hr.; railway operation, 280,000,000 kw.-hr.; electrochemistry and electrometallurgy, 580,000,000 kw.-hr.; exported power, 521,000,000 kw.-hr. The consumption per inhabitant in Switzerland was 650 kw.-hr. per year.

The total capitalization of both publicly and privately owned plants engaged in the generation and distribution of hydro-electric power is approximately 1,000,000,000 francs. Forty-eight per cent of the installed hydro-electric power is privately owned and the remainder is operated by the different municipalities, cantons and the Swiss government. Of seventy-one companies distributing power to the public, only six, with a capitalization of 33,900,000 francs, failed to pay any dividends, while the remainder, with a capitalization of 300,000,000 francs, paid a return of 5.73 per cent.

The plants now in process of installation, totaling 497,000 hp., will bring the installed capacity of the country up to 1,977,000 hp. and the annual output to 5,870,000,000 kw.-hr. Even this is only 30 per cent of the total hydro-electric power available, and new stations are projected now in the areas on the Rhine, Rhone and Aare Rivers which will increase the power available more than 1,000,000 hp.

Central-Station Industry Operating at Normal


ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
A=Estimated normal trend of energy generated
B=Average daily energy generated, by months
C=Average daily gross revenue, by months
D=Estimated normal trend of gross revenue
165.0 Feb.
147 Feb.
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
187 Feb.
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating expenses, Millions of Dollars
1917 1918 1919 1920 1921
1922
1923
1924
1925

THE amount of energy generated by the electric light and power systems of the country totaled 4,621,235,000 kw.-hr. during February, a daily average of 165,000,000 kw.-hr., as against 154,200,000 kw.-hr in February last year, an increase of 7.0 per cent. This is the fourth consecutive month during which the output virtually coincided with the ELECTRICAL WORLD'S estimated normal output for the month concerned.

A new record in average daily gross revenue was established by the industry during February with a total of $4,470,000. The total revenue for the month was 7.1 per cent above February of last year and 10.6 per cent above the estimated normal for the month. The operating ratio for companies having steam plants only was 42.9 per cent, the lowest figure recorded since 1920. In February of last year this figure was 45.7 per cent.

Complete returns of central-station operations during 1924 are now available. The energy generated by electric light and power systems during that year totaled 54,522,981,000 kw.-hr. a gain of 6.0 per cent over 1923; the amount of energy consumed for lighting purposes totaled 12,902,000,000 kw.-hr., a gain of 15.2 per cent over 1923; the amount of energy sold to electric railways totaled 6,402,530,000 kw.-hr., a gain of 6.8 per

TABLE III—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL POWER PLANTS IN THE UNITED STATES

(100 per Cent of the Industry)

Month	Energy Generated				Fuel Consumption		
	Hydro Plants		Fuel Power Plants				
1924	Thousands of Kw.-Hr.	Per Cent	Thousands of Kw.-Hr.	Per Cent	Coal (Short Tons)	Oil (Barrels)	Gas (Thousands of Cubic Feet)
December...	1,724,970	33.8	3,376,822	66.2	3,173,141	1,328,668	2,940,598
1925							
January....	1,698,484	33.0	3,443,591	67.0	3,232,314	1,354,927	2,896,134
February...	1,725,877	37.4	2,895,358	62.6	2,741,313	959,595	2,457,463

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES

(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly			Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business Including Line Losses, Kw.-Hr.			
1924	1924 Thousands	1923 Thousands	Per Cent Inc.	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands
December....	5,101,792	4,521,208	13.0	4,117,792	3,649,208	1,204,000	1,045,000	2,366,792	2,089,208	547,000	515,000	984,000	872,000	803,000	731,000
1925	1925	1924		1925	1924	1925	1924	1925	1924	1925	1924	1925	1924	1925	1924
January.....	5,142,075	4,792,704	7.2	4,149,575	3,867,704	1,168,000	1,117,000	2 445,575	2.227.704	536,000	523,400	992,500	925,000	760,000	712,000
February....	4,621,235	4,470,153	3.3	3,729,235	3,608,903	1,044,000	1,000,000	2,201,235	2,134.903	484,000	474,000	892,000	861,250	745,500	663,000

TABLE II—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS IN THE UNITED STATES

(100 per Cent of the Industry)

Month	Gross Revenue from Sale of Energy			Operating and Maintenance Expenses			Operating Ratio					
							Steam Plants		Hydro Plants		Combined Steam and Hydro Plants	
1924	1924 Thousands	1923 Thousands	Per Cent Increase	1924 Thousands	1923 Thousands	Per Cent Increase	1924	1923	1924	1923	1924	1923
December.....	$131,700	$119,200	10.4	$56,600	$51 750	9.1	45.8	48.0	27.4	26.2	44.0	44.0
1925												
January.....	134,800	120,700	11.7	57,100	52,900	7.7	45.3	47.0	26.0	24.6	43.4	43.0
February...	125,200	117,000	7.1	52,450	50 720	3.4	42.9	45.7	30.9	27.1	40.3	44.0

cent; energy consumed for power purposes totaled 24,698,451,000 kw.-hr., a gain of 1.7 per cent; energy lost in transmission and used in intracompany business totaled 10,520,000,000 kw.-hr., a gain of 5.8 per cent; energy sold to other public utilities for resale totaled 8,985,810,000 kw.-hr., a gain of 21.9 per cent; the gross revenue totaled $1,354,570,000, a gain of 6.7 per cent, and the operating and maintenance expenses totaled $617,980,000, a gain of 7.3 per cent.

Letters from Our Readers

Embargo on Power Exportation Strongly Opposed in Canada

To the Editor of the ELECTRICAL WORLD:

Notwithstanding the attitude which the Quebec government recently assumed toward the export of electric power, it is understood that an agreement will shortly be reached permitting the Carillon Falls project to be proceeded with, says a Quebec paper invariably used by Premier Taschereau when making a *ballon d'essai.* Significant also is the statement made by the federal Minister of Public Works, J. H. King, in Parliament the other day: "I cannot think my honorable friends are really serious when they talk of an embargo which would prevent the raw materials of the country going out of Canada. If that should come to pass, then the Lord help Canada!" The Minister then intimated that the Dominion government considered an export duty on power a promising source of revenue. Necessarily, under the principle of Cabinet responsibility, the Minister expresses the attitude of the government.

The export embargo idea would appear to have become such a shuttlecock of politics that it is likely to be left in the air. Approved by the Liberal Premier of Quebec, it has just been soundly attacked by several leading Liberals of the province. Thus Andrew McMaster, M.P.: "We shall be doing a wise thing to develop our surplus power for export. The blessed thing about such exports is that at the end of the year we have as much to send out as we had when the year began. I have no objection to export duty on power so long as it is very small." Again, while the embargo idea is supported by Conservatives at Ottawa, *Le Matin,* a leading organ of Conservative opinion in the Province of Quebec, has condemned it as a fantastic principle which would lead to government interference in all kinds of private enterprise.

Further, on May 15, representatives of the Liberal government of New Brunswick will appear before the International Waterways Commission seeking sanction for an agreement with the State of Maine necessary to proceed with the development of Grand Falls on the St. John River. It is fairly certain that Maine will insist that a certain proportion of the power developed be exported across the border, for though Grand Falls is within New Brunswick territory, effective utilization will require the provision of storage facilities on the upper reaches of the St. John River in Maine. And the Canadian government does not possess the constitutional power to interfere with the provincial authorities in matters concerning contractual or property rights, unless such interference can be made in the name of a national emergency. C. MCKAY.

Montreal, Canada.

Applications of Fused Quartz

Products Made from This Material Include Medical Instruments, Tuning Forks, Thermometers, Lenses and Others

FOR more than a hundred years many scientists have realized the thermal value and great transparency of quartz, and during the last twenty-three years steps for fusing quartz into various forms have been advanced. In the past year E. R. Berry, chemist of the General Electric Company, has made fused quartz a commercial possibility by use of a highly developed electric furnace. For many years it has been possible to make fused quartz in small quantities, but the recent process developed by Mr. Berry makes it possible to produce this material on a commercial basis.

When the quartz has once been fused it can be shaped into ribbons and tubes up to 30 ft. in length and into any other form desired. Fused quartz can be heated to a very high temperature and plunged into cold water without fracturing. This property makes it of value for use in lenses for motion-picture machines where high temperatures often crack plain glass lenses.

GLASS VERSUS FUSED QUARTZ

A rod of the best glass and a rod of fused quartz of the same size placed in line with a light show that the light rays go a few inches into the glass rod and are absorbed. In a fused quartz rod the light will go through the entire length of the rod and come out at the farther end with very little loss. A bent rod of fused quartz will carry the light rays through as well as a straight rod.

The General Electric Company's chemists have been working upon a device for cauterizing tubercular spots in the larnyx. A rod of ½-in. diameter with one end in a 90-deg. bend carries heat rays produced in a high-intensity incandescent lamp to the spot to be cauterized.

Tuning forks made of fused quartz give a very true tone as quartz has the smallest coefficient of expansion of all the materials of which tuning forks are made. Once a fork is correct as to pitch, it will remain virtually so, regardless of heat changes. Thermometers made of this material have been found to be very satisfactory and very accurate.

The fact that fused quartz is not affected by temperature changes makes it of considerable value in lens for telescopes. Light rays are transmitted into the extreme ultra-violet range with little absorption. The dispersion of quartz is higher than that of glass and its index of refraction lower.

The quartz crystal from which the finished product is made comes from Brazil. The crystals are packed in a graphite or carbon crucible and placed in a vacuum furnace, and the temperature is raised as quickly as possibly to the melting point of the quartz. The result of this first fusion is a clear, transparent slug containing few bubbles. This slug is then placed in a graphite crucible, which is suspended in a vertical carbon-tube furnace. A graphite piston which fits the crucible is placed on top of the fused-quartz slug, and a weight is placed on top of the plunger. The slug is again heated, and any bubbles, if present, are forced out and the quartz extruded into various shapes as desired.

A rod of fused quartz will emit 93 per cent of the light it receives, while the best grade of glass will emit only 65 per cent.

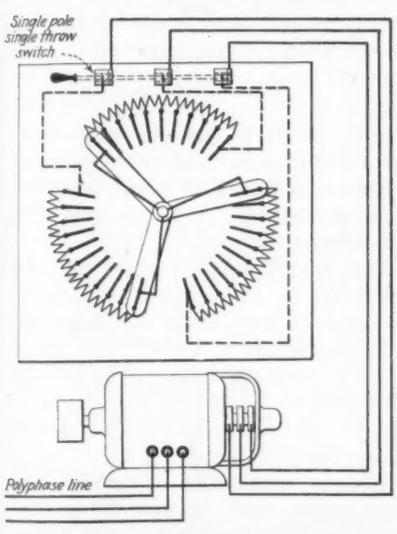
Central Station and Industrial Practice

Short-Circuiting of Slip-Ring Motors

BY F. E. BELL
Sioux City, Iowa

DURING the course of the past few years the writer has had quite a bit of experience with various types of starting resistors on slip-ring motors. Normally as the motor is brought up to speed by cutting out the resistance, the rings are short-circuited by laminated bronze-copper strips on the operating handle.

Where the starter is mounted in a



KNIFE-SWITCH FOR SHORTING SLIP-RING MOTOR STARTING RESISTANCES

location so that it is subject to continual vibration, these laminations have a sliding effect on the stud to which the slip-ring leads are attached. In doing this, they allow a semi-open condition through the resistance, causing the last plate contacts to heat to redness.

After investigating the cause of this trouble, it was decided to short-circuit the secondary leads completely after the motor had been brought up to speed. This was done by taking a single-pole knife-switch with two jaws and mounting, as shown in the accompanying illustration.

In one case, before this was done, an air compressor ran very unevenly and fuses blew in the main feed due to heavy loads on the compressor, jarring loose the laminations on the starting resistance.

It might be expedient for any one having motors with starters of this type to short-circuit the secondary loads ahead of the resistance after all resistance had been cut out, thus saving a great deal of unnecessary trouble.

Increasing Accuracy of D.-C. Ammeters

New York Edison Company Using 5-Amp. Manganin Shunts on 1,000-Amp. Direct-Current Feeders—Accuracy Is Entirely Satisfactory

BY W. B. KIRKE
Research Engineer Electrical Engineering Department,
New York Edison Company

CONSIDERABLE effort has been made during the last few years by the distribution department of the New York Edison Company to equalize the currents in the low-tension direct-current feeders. This is being done to make available the full capacity of feeder copper by equalizing the cable copper temperatures. It is planned by adjusting the feeder lengths to keep the maximum load on all except the very short feeders to within a range of ± 100 amp. of the average.

For this undertaking greater accuracy was required of the feeder-indicating ammeters, which were sometimes found to be from 50 amp. to 100 amp. in error. These instruments were operated as millivoltmeters, using the station length of cable as a shunt, as shown in Fig. 1. A pilot wire in the cable was used to connect the millivoltmeter to the cable at the splice in the first manhole. The length of the station cable from the bus to the first manhole varies in the different stations from 35 ft. to 500 ft. This length

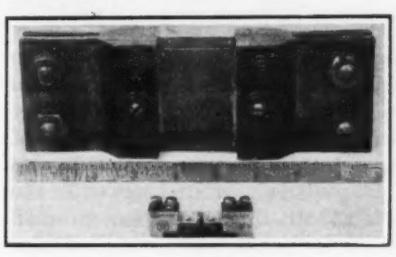


FIG. 4—RELATIVE SIZE OF BUS SHUNTS

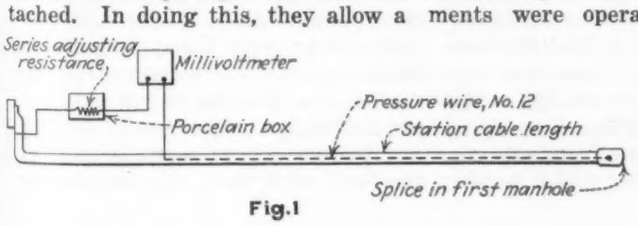


Fig. 1

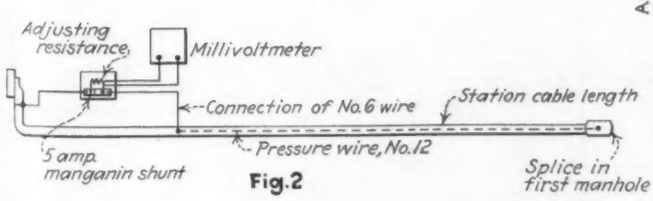


Fig. 2

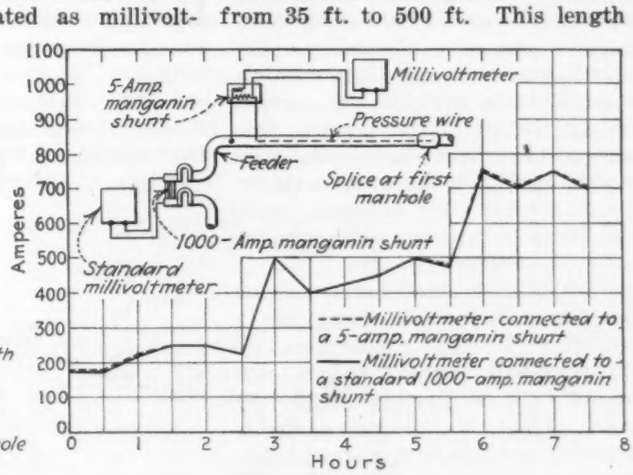


Fig. 3

FIG. 1—ORIGINAL INSTRUMENT CONNECTIONS. FIG. 2—CONNECTIONS USING 5-AMP. MANGANIN SHUNT
FIG. 3—COMPARISON OF ACCURACY OF 5-AMP. AND 1,000-AMP. SHUNTS

of cable, used as a shunt, gave a much greater potential drop than was required to operate the millivoltmeter, and a series adjusting resistance was placed in the millivoltmeter circuit to reduce the potential difference applied to the instrument to the proper values.

When the instruments were adjusted with a standard at low currents, with the cable cool, it was found that their indication would be too high at heavy loads. This was due to the potential drop along the feeder being more than directly proportional to the current in the cable on account of the higher temperature and resistance of the cable at heavier loads. This effect was recognized more than twenty-two years ago, and at that time the copper adjusting resistances were wound around the cable sheath to raise the temperature and resistance of the millivoltmeter circuit as the load on the cable increased. This connection provided fair instrument accuracy. It was found, however, that the series adjusting resistances were subject to mechanical injury due to their exposed positions and required considerable maintenance. At a later period the adjusting resistances of fine copper wire were removed from their positions in contact with the cable sheath to be installed in small porcelain boxes, but this change lowered the accuracy of the instruments.

To overcome these disadvantages the instrument connection was finally changed to one where the millivoltmeter circuit is connected across a small 5-amp. manganin shunt installed in the pilot-wire circuit, as shown in Fig. 2. The resistance of this 5-amp. manganin shunt is less than 10 per cent of the resistance of the pilot-wire circuit. Since the pilot wire in this connection is in multiple with the main cable, it will carry a certain portion of its current. The ratio of the current in the pilot-wire circuit to that in the main cable remains constant for different loads, since both circuits are subject to the same temperature changes.

The millivoltmeter connected across the 5-amp. manganin shunt has a deflection directly proportional to the pilot-wire current and is calibrated to read the current in the main cable. If the instrument is adjusted to agree with a standard at some given load, it will read other loads accurately, as it automatically compensates for temperature changes.

Comparative readings of the same load using a 1,000-amp. manganin shunt and a 5-amp. manganin shunt are shown in Fig. 3, indicating that almost complete compensation has been obtained for temperature changes. Errors which were formerly encountered in the neighborhood of 100 amp. are now reduced to within a range of 10 amp., the resulting accuracy being entirely satisfactory for the requirements.

The relative sizes of the 5-amp. and the 1,000-amp. manganin shunts, which give practically the same instrument accuracy, are shown in Fig. 4.

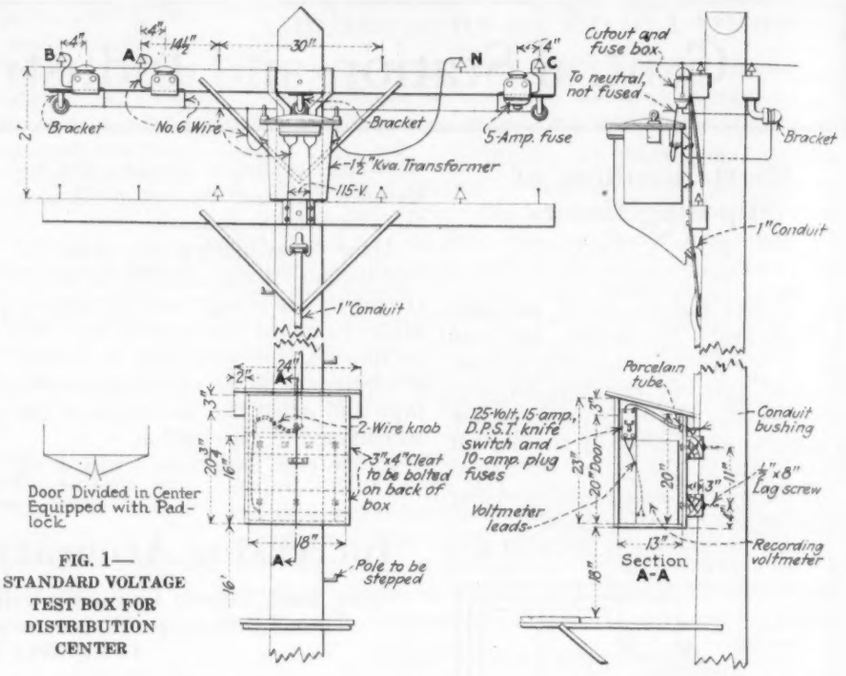


FIG. 1—STANDARD VOLTAGE TEST BOX FOR DISTRIBUTION CENTER

Test Boxes for Maintaining Economical Voltage

IN ORDER to check the voltage of each distribution feeder on its system, the Utica Gas & Electric Company has installed a standard test box and transformer at the center of load of each circuit. The equipment consists of three fused cut-outs, a 1½-kva. transformer and a wooden box for holding the recording voltmeter. The layout of the apparatus is shown in Fig. 1. Voltage tests are made periodically or at the time of a low-voltage complaint.

The distribution system of the company is three-phase four-wire. As may be seen from the drawing, only one phase is tested at a time. The cut-outs on each phase are all connected to a common wire, the circuit tested being the only one of the three that is fused.

From a standpoint of service and economy it is of the utmost importance to maintain a uniformly regulated circuit voltage. In addition to uniformity it is commercially desirable to maintain the center of distribution voltage at as high a value as is consistent with the securing of full rated life from lamps specified for system use. Using 115-volt lamps, it has been found that a value which works out satisfactorily is, "As close as possible to 118 volts but not higher." As increase of voltage and increased lamp wattage vary in the ratio of 2 to 3, the importance

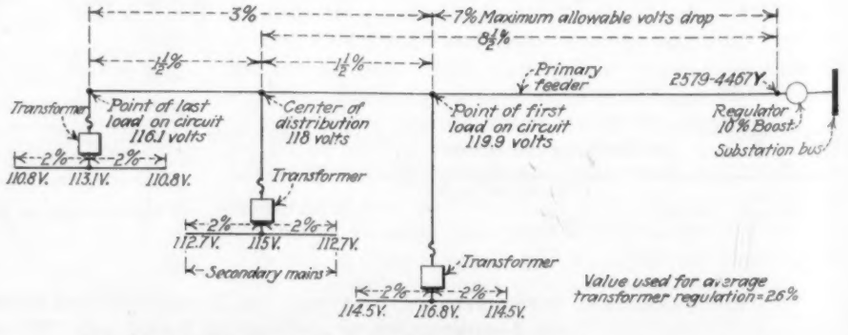


FIG. 2—MAXIMUM ALLOWABLE VOLTAGE DROP FOR LIGHTING CIRCUITS

of maintaining the upper limit can be readily appreciated. Experience has shown, however, that to allow a voltage variation above this value at the center of distribution results in high-voltage complaints.

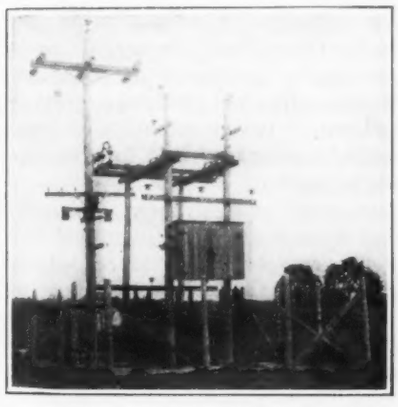
In Fig. 2 is shown a diagram of maximum allowable voltage drop which serves as a basis for commercial lighting circuit calculations and regulation as it has been applied to the Utica system.

Servicing Rural Territory

Development and Improvement of Rich Agricultural District in North Carolina Aided by Construction of 33,000-Volt Line

BY J. W. CARPENTER
Treasurer General Engineering & Management Corporation, New York

THERE has been in regular operation for more than a year an interesting example of "home-made" transmission line serving farm territory in the southern section of the United States. A great deal of the material entering into the construction and all of the labor were obtained locally. This line is a 33,000-volt circuit extending from the steam plant of the Tidewater Power Company at Wilmington, N. C., northwest through a rich agricultural territory which is undergoing rapid development and improvement.



TYPICAL SMALL SUBSTATION

The line extends approximately 72 miles northwest of Wilmington to Mount Olive, N. C., and follows the general direction of the branch line of the Atlantic Coast Line Railroad. This section is exceptionally well adapted to the raising of strawberries, fresh vegetables, tobacco, cotton, potatoes and a great diversity of farm products. The introduction of new paved highways, co-operative marketing facilities and electric power is doing much to accelerate the rate of development.

The type of construction used was wooden poles and cross-arms. clamp-type pins and 45,000-volt insulators. The poles were about half juniper and half black cypress and all of them were procured from a mile to 10 miles from the line. In fact, in a few instances it was possible to lop branches from cypress trees and use the poles thus made right in their rooted settings. From twenty-six to thirty poles per mile were used for ordinary conditions of construction. Black-heart cypress cross-arms were obtained from local mills and delivered as required. Except for corners, crossings and substations a single two-pin arm measuring 4 ft. 6 in. in length was used. Two clamp-type pins were placed on each arm and a pole-top pin was used for the third wire. No. 2 medium-hard-drawn copper wire was used over the entire length of the line. No static or ground wire was used, but all substations were equipped with choke coils and horn gaps, and three sets of electrolytic lightning arresters were placed at important substations.

CYPRESS TREES UTILIZED FOR POLES

As originally considered and designed, this extension was intended to be a high-grade power line for small towns and farming centers, but the interest shown in it and the possibilities that appeared led to the development of it as a high-voltage transmission line and an interconnecting link between two adjacent power companies.

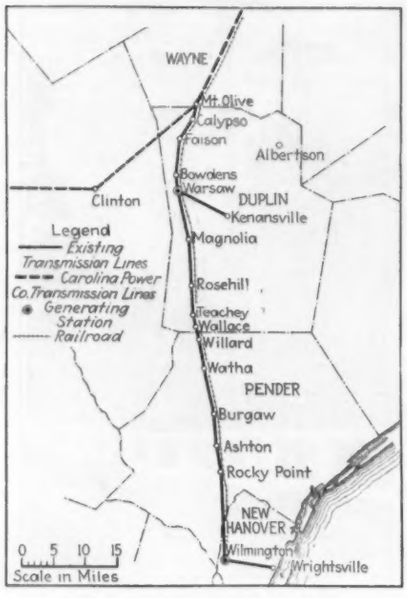
This line was built along the state highway over about half of its length as the power company has the right under its state charter to build along highways without obtaining independent rights-of-way. The other half of the line is on private right-of-way secured from property owners at a very low cost. Negotiations were carried on with communication and railroad companies, and an agreement was reached whereby the line does not at any place come closer

MONTHLY CONSUMPTION OF RURAL TOWNS IN KILOWATT-HOURS

Town	Township Population	Township Population	Customers	1923 Dec.	1924 Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Average Consumption per Customer per Month
Rocky Point (*)	200	1,774	25	12,561	17,196	12,877	18,912	7,458	1,207	993	910	1,012	1,024	666	711	185
Burgaw	1,040	2,657	152	6,405	6,510	5,880	6,195	4,830	4,620	4,700	4,700	4,800	4,700	5,355	6,300	35
Wallace	648	4,512	225	7,875	7,665	6,515	6,825	6,930	7,420	6,070	8,288	12,680	11,590	15,885	20,355	43.7
Rose Hill	516	1,527	90	2,415	2,415	1,995	2,100	1,995	1,680	2,200	2,200	2,200	2,200	2,200	3,360	25
Magnolia	694	1,952	64	934	1,354	1,247	1,212	1,243	1,144	1,266	1,156	1,109	1,219	1,320	1,790	19.5
Warsaw	1,108	3,481	255	.....	10,549	10,596	10,209	10,511	10,463	11,473	10,870	8,400	13,936	12,159	13,678	43.7
Keanansville	302	2,432	48	.....	.....	.....	.....	.....	889	989	1,090	985	1,095	1,318	1,478	23.3
Faison	477	4,147	84	525	1,155	1,890	2,205	1,575	1,524	1,669	1,774	1,708	2,390	6,565	9,762	32.5
Calypso	405	.....	74	.....	691	1,202	1,379	1,606	1,325	1,546	1,654	1,395	1,836	2,238	2,482	21.4
Mount Olive (†)	2,297	6,689	461	33,495	36,015	37,248	36,888	39,208	45,414	48,944	55,584	57,496	39,504	.....	.....	93
Total	7,887	29,171	1,478	64,210	83,550	79,450	85,925	75,356	75,686	79,850	88,226	91,785	79,494	47,706	59,916	

* Including large stone quarry for road construction to April, 1924. † Including ice plant.

than 1,000 ft. to the telegraph and telephone circuits and in most places is from a quarter mile to 5 miles away. This separation was deemed advisable, although the power company could have built with advantage to itself almost parallel and at a very close distance to the lines of the other companies.



TOWNS SERVED BY 33,000-VOLT TRANSMISSION LINES

Owing to the fact that all material, including poles and crossarms, as well as all the labor, was procured along the line, the cost of construction was held to a comparatively low figure. Economy was, moreover, helped by the fact that many of the towns served were instrumental in procuring right-of-way over property at little or no cost. The entire construction of 72 miles of this 33,000-volt construction, including all transformers, station connections, substations and protective apparatus, cost just about $175,000.

This transmission line was financed in some cases by the communities themselves and in others by residents of the towns. From two-year to twenty-year notes of the power company were taken by towns in return for cash which they advanced. Likewise a considerable amount of preferred stock was sold to private individuals. The total effect of this local financing amounted to about 20 per cent of the entire cost.

As originally instituted, the service was to be on the basis of long-term contracts, either with municipally owned distribution systems or with privately owned small companies. These contracts were all made for a period of twenty years. In the towns franchises were obtained merely for the transmission line, but as service has become available, many of the towns have shown their desire to step out of the electrical business and have sold their local distribution equipment and granted long-term franchises to the power company. As a result of this construction five municipally owned power systems have been turned over to private operation.

The load served by the line consists largely of residence, store and farmhouse lighting, with a diversification in the nature of ice-making, cotton-gin and road-building plants. The availability of this power has brought about further uses, and motors are constantly being installed for various small operations. The accompanying table shows the principal towns served and their population as well as that of the surrounding townships, the number of customers and the monthly consumption for the first year of operation.

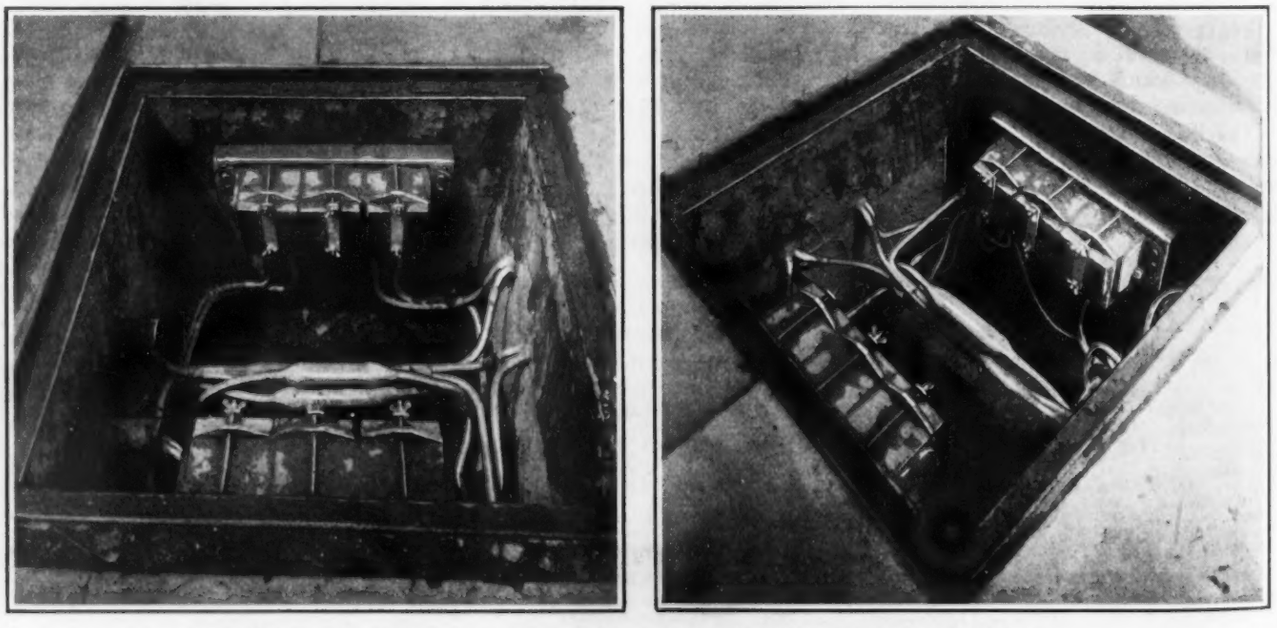
One further advantage from the building of this line was an arrangement for interconnection with the transmission system of the Carolina Power Company. The two companies exchange power and connection between their systems has just been completed. This made the city of Wilmington the first Southern seaport to have hydro-electric power available.

The design, construction and negotiations for this extension were carried on by the General Engineering & Management Corporation.

Secondary Sectionalizing Units for Subway

THE growth of underground alternating-current secondary systems from small isolated sections into large networks has been so rapid that the fact that there are serious problems in the operation of such networks is often not realized until they are brought to our attention by some trouble that may result in interruption to service.

In many cases these networks start when sections of overhead distribution systems are placed under ground and the principles of overhead design are applied to the underground construction without considering the different conditions under which the new system is to operate.



SUBWAY SECTIONALIZING UNITS REDUCE INTERRUPTION OF SERVICE TO A MINIMUM

In overhead secondary systems it is seldom found necessary to provide means for disconnecting branches and services, because the wires may be disconnected and retapped easily and quickly and the spacing is such that the work can be done with little danger of short-circuits or grounds.

If taps in underground construction are made solid, it is difficult to isolate faults in cables and long delays are necessary to saw off cables or open up splices. Then, when the fault has been repaired, it is sometimes necessary to interrupt the entire secondary to reconnect the defective branch. It is fairly well agreed among engineers that some means of quickly sectionalizing underground secondary systems is necessary, but there is considerable difference of opinion as to the degree to which this should be carried.

A type of sectionalizing unit that has proved very satisfactory for this service is manufactured by the Metropolitan Device Corporation of Brooklyn, N. Y., and is illustrated in the accompanying illustrations. The units are made of porcelain with copper busbars and connections and in two styles, one using a removable knife blade for disconnection and the other having lugs bolted to the bus through a sheet of fiber insulation. These units may be assembled in combinations to fit any requirements. All units are single-pole, and it is therefore possible to separate the two polarities by placing one on each side of the manhole or distribution box. Individual covers are placed on each unit and any connection may be reached by removing two thumb nuts. This results in a considerable saving in time over the method of using a single iron cover held down by a large number of bolts.

A watertight connection of the lead cable to the unit is made by calking with lead floss and the usual costly wiped joint is not necessary. The porcelain construction and the separating of the polarities into two units make short-circuits and grounds practically impossible and there is no danger of accidental shorts from dropped tools.

The knife blade with detachable handle, which is used for disconnecting transformers and heavy mains, makes it possible to pick up or disconnect load without arcing and therefore without interruption to service on the remainder of the secondary. For the smaller mains and services, connection is made by a cap-screw passing through a fiber cover into the bus. By removing the cap-screw, the service is disconnected and the fiber cover separates the lug from the bus.

Compact Back-of-Board Arrangement

By D. D. Clarke
Electrical Engineer Kansas City Power & Light Company

A DEPARTURE from the conventional arrangement of the back of Edison three-wire feeder switchboards has been made in one of the Kansas City Power & Light Company's stations with several attendant advantages. Among them are (1) considerable separation between uninsulated circuits of opposite polarity, (2) convenience and safety of repair work, (3) confinement of arcs from fuses, (4) protection of cables from flashes to ground, and (5) easy identification of circuits. Still, the switchboard is compact.

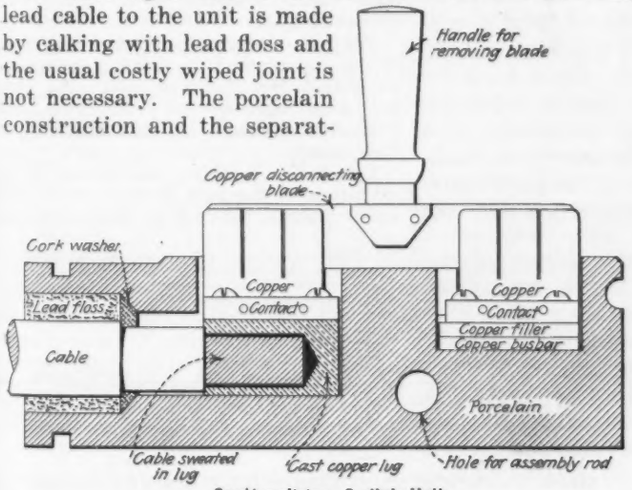
One switchboard having these features is illustrated. It controls eight 220-volt, 1,500,000-circ.mil feeders. As shown, the line terminal of each switch is extended backward from the board to a short vertical bar dropping to the corresponding fuse box and outgoing-feeder cable. The top row of fuse boxes is on the positive side of the line and the bottom row is on the negative side. Since the fuses are below the normal line of vision, it was considered advisable to inclose them, to confine arcs and protect workmen. Each box is hinged at its upper edge so as to lift up in case of an explosive blowing of the fuse and also to permit replacement of fuses.

COMPACT ARRANGEMENT OF SWITCHBOARD APPARATUS

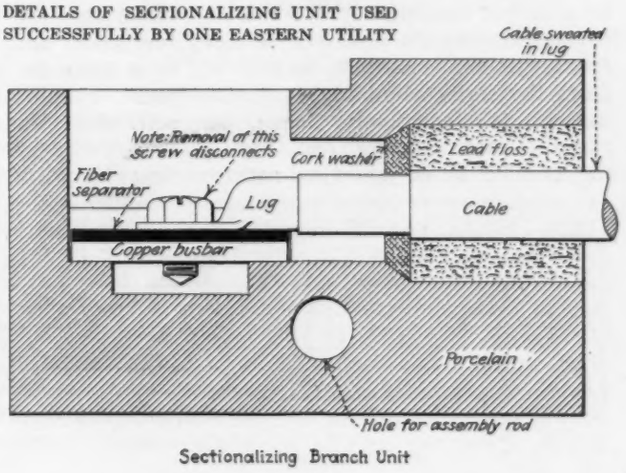
From the bottom of each fuse box the feeder cables are trained into vertical runs leaving through porcelain-bushed conduits in the floor. Above the floor the cables are taped to minimize flashes to ground and spread of disturbances. Corresponding switches, fuse boxes and cables are numbered for ready identification of circuits.

A tough grade of alberine stone is used for insulation on this board to interpose sufficient resistance to ground to permit megohm tests on the cables without appreciable error due to low stone resistance.

DETAILS OF SECTIONALIZING UNIT USED SUCCESSFULLY BY ONE EASTERN UTILITY



Sectionalizing Switch Unit



Sectionalizing Branch Unit

Commercial Activities and Public Relations

Keeping the Domestic Appliance Working

A CENTRAL-STATION company's interest in an electric household device should not end with its sale, for if the appliance fails to operate from any cause whatsoever, the customer very likely becomes dissatisfied with his purchase and his opinion of the electric service company is not improved. This presents an opportunity for the utility company to render a service under circumstances that will further stimulate satisfactory customer relations, especially if the appliance was purchased elsewhere. Also failure of the apparatus to operate takes a revenue-producing device off the line and may in the aggregate appreciably affect the revenue from all domestic customers.

To prevent such conditions the Dayton Power & Light Company, Dayton, Ohio, includes attention to customers' devices as part of its trouble department's duties and extra effort is made to render an almost immediate repair service on such trouble calls. The company's policy and method of handling this service may be illustrated as follows:

A customer finds that for some reason her flatiron has ceased to operate and calls the electric service company, giving to the trouble dispatcher her name, address and the nature of the trouble. The time the call is received is recorded and a service man (one of whom calls in after each visit or reports at the dispatcher's office) is summoned and given the necessary data. Furnished with a light roadster or similar car, he sets out immediately for the reporting customer's premises (either from the last premises visited or from the service building). Arriving at the customer's home, he remedies any minor defect, but if the trouble is of a major nature, he so advises the customer and leaves a company iron for use until the defective iron is repaired and returned. Minor repairs are made gratis and major repairs are performed at nominal cost.

Before leaving the customer's premises the service man telephones the company dispatcher's office to inquire if any other calls are to be made in the neighborhood so that service can be given without delay.

Consulting Service for Power Customers

Readiness of Central Station Company to Investigate and Suggest Remedies for Uneconomical Use of Power Brings Business and Good Will

BY J. R. HALLADAY
Meter Relay Engineer, Warren Division,
Ohio Public Service Company, Warren, Ohio

THE policy of the Ohio Public Service Company is to render every service possible to its customers in order to obtain for them the greatest return for a given consumption of power. Not only is its attention centered on supplying uninterrupted power at a constant voltage, but it has a staff of men who devote a large part of their time to investigating the power equipment of their customers.

The following is a typical case of how this service has been beneficial to both company and customer: A complaint was received from a customer that the bill was high. Some few years ago this would have led to a more or less protracted argument, culminating ultimately in a settlement unsatisfactory to both. In this case, however, the power sales department, in conjunction with the meter department, undertook an investigation to determine why the bill should be high.

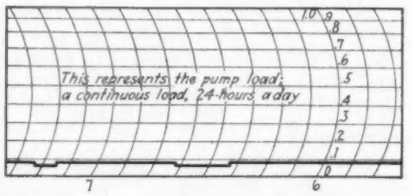


CHART 3—OIL AND WATER PUMPS BECAUSE OF CONTINUOUS SERVICE FORM AN APPRECIABLE PART OF CONSUMPTION

There was no doubt as to the accuracy of the recording devices, as they are inspected once a week and checked at frequent intervals, so that the cause was sought elsewhere. The particular customer operated a small steel plant using power for the operation of oil and water pumps and four motors rated at 10, 25, 30 and 50 hp. respectively. The motors drove line shaft supplying a number of countershafts, all using leather belts. After a thorough test with graphic meters had been made, a report was submitted to the manufacturer, of which the following is a copy:

We are pleased to submit the following as a result of the test run in your rivet department. All conclusions are based on charts taken from graphic demand meters cut into the line at your main oil circuit breaker.

Chart No. 1 is an excellent sample of the typical load on your night turn. This chart is labeled so as to be self-explanatory.

We have summarized your total load chart and plotted the load components on Chart No. 2. You will note that we have indicated the friction of each line shaft as well as load on each of the motors.

Chart No. 3 is inserted to call your attention to the fact that your oil and water pumps, because of their continu-

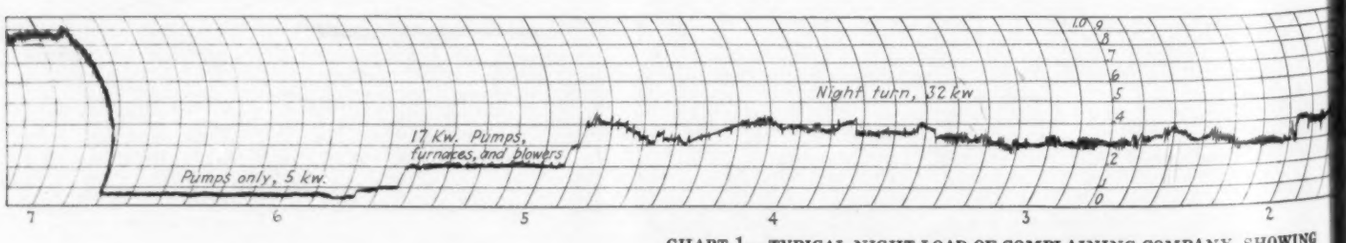


CHART 1—TYPICAL NIGHT LOAD OF COMPLAINING COMPANY, SHOWING

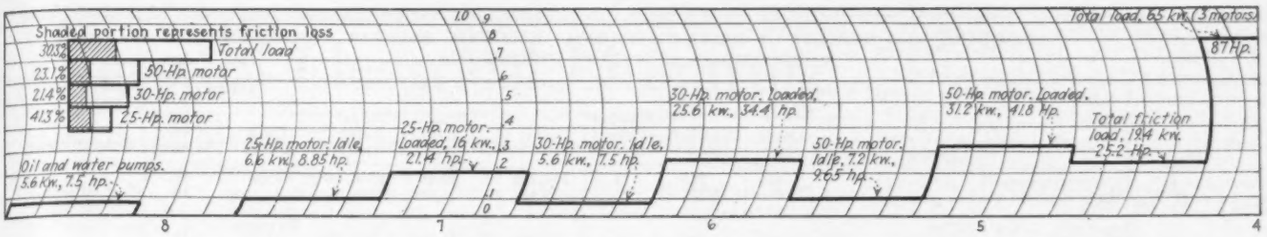

Shaded portion represents friction loss
30.3%
23.1%
21.4%
41.3%
Total load
50-Hp. motor
30-Hp. motor
25-Hp. motor
Oil and water pumps. 5.6 kw., 7.5 hp.
25-Hp. motor. Idle, 6.6 kw., 8.85 hp.
25-Hp. motor. Loaded, 16 kw., 21.4 hp.
30-Hp. motor. Idle, 5.6 kw., 7.5 hp.
30-Hp. motor. Loaded, 25.6 kw., 34.4 hp.
50-Hp. motor. Idle, 7.2 kw., 9.65 hp.
50-Hp. motor. Loaded, 31.2 kw., 41.8 hp.
Total friction load, 19.4 kw. 25.2 Hp.
Total load, 65 kw. (3 motors) 87 Hp.

CHART 2—GRAPHIC METER INDICATED NEARLY 27 PER CENT FRICTION LOSS INSTEAD OF 5 TO 10 PER CENT

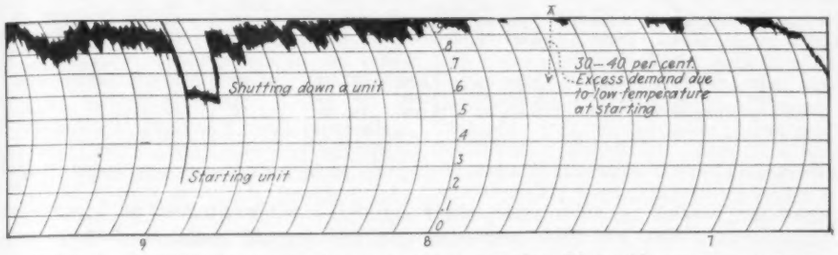


CHART 4—FIRST PART OF TYPICAL DAY LOAD, SHOWING 30 TO 40 PER CENT EXCESS DEMAND IN STARTING ANNEALING FURNACES

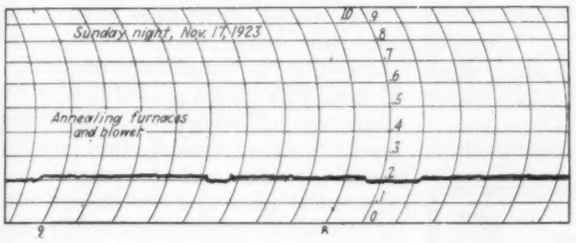
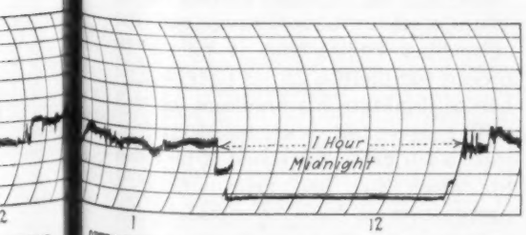


CHART 5—LOAD CAUSED BY ANNEALING FURNACES WITH PUMPS RUNNING, INDICATING 10 KW. DEMAND FOR FURNACES ALONE

ous operation, form an appreciable part of your consumption. The monthly consumption in kilowatt-hours on these units is approximately 4,320, which, at $0.0135 per kilowatt-hour, costs you $52.32 per month. With the extra demand indicated of 6 kw. at $1.80 per kilowatt-hour, the demand charge amounted to $10.80 and brings the total cost for pump operation to $69.12 per month. We have not investigated the nature of the set-up of these units and merely insert these figures to show that this is no small item. An improvement in the operation of these units would be well worth while.

Chart No. 4 represents a typical day turn. The most important fact to be learned from this chart is that the morning start of the annealing furnaces, owing to low temperature, establishes a demand that is from 30 kw. to 40 kw. in excess of normal.

Chart No. 5 is a curve of the annealing furnace load (pumps also running). The demand in this case is approximately 16 kw. Subtracting the 6-kw. demand of the pumps, the net demand of the furnaces amounts to 10 kw. This will show that your cost of operating this unit is about $1.35 per hour, exclusive of demand charge.



OWING

OPERATION OF PUMPS, FURNACES AND BLOWERS

The hourly cost of operation of the various groups tested is as follows:

	Kw.	At	Cost
1. 50-hp. motor	31.2	$0.0135	$0.421
2. 30-hp. motor	25.6	0.0135	0.346
3. 25-hp. motor	16	0.0135	0.216
4. 10-hp. motor	10	0.0135	0.135
5. Pumps	6	0.0135	0.081
6. Friction loss (items 1, 2 3).....	19.4	0.0135	0.262

Item 6 indicates that approximately 26.6 per cent of power consumption is due to friction loss. Line-shaft loss should be about 5 per cent according to standard practice. With your set-up, however, where there are a large number of belts and countershafts, this figure could not be reached, but accepting 10 per cent as a possibility, a saving of approximately 17 per cent could be made without a very large investment.

It cannot be too strongly emphasized that tight belts and improper location of pulleys on the line shaft have a great effect on friction losses. It is recommended that a periodic inspection of belts and shaft alignment be made. Attention to these items would, in our opinion, pay high dividends.

As a result of this investigation and report, changes were made which raised the power factor from 60 to 80 per cent with a corresponding lowering in the demand charge. In addition, an overhauling of the line shaft made a material reduction in the amount of power used.

Not only have good relations been maintained between this customer and the company through similar services, but such confidence has been established that the company representatives are always called in for consultation in matters of power uses, and purchase of correction equipment and other necessities is made through the company.

Electric Ironers as Load Builders

NINETY-SEVEN No. 30 Thor electric ironers were sold from March 9 to March 31 by the Washington Water Power Company, Spokane, Wash. These ironers, with connected load of 1,100 watts each, added 107 kw. to the connected lighting load and will produce an additional annual revenue of $700 per year, based on the rate of 3 cents per kilowatt-hour, which prevails in Spokane.

This campaign was carried out by the regular sales organization under the direction of L. A. Lewis, sales manager Washington Water Power Company, with a store demonstrator furnished by the manufacturer.

Because of the comparatively new idea of an electrically heated ironer suitable for connection to a convenience outlet, most of the machines were sold as the result of home demonstrations. The percentage of machines returned after demonstration was very small. The ironers were sold on terms of $5 down and $7.50 per month.

Campaign Plan Sells Appliances Worth $112,392

DURING 1924 the British Columbia Electric Railway Company, conducting its new business activities on a predetermined schedule, put on eight successful campaigns, featuring electric ranges, washing machines, vacuum cleaners and kitchen-lighting units. The total value of merchandise sold was $112,392, and more than 900 kw. in connected load was thus added to the lines of the company. To sell a total of 272 washing machines, 343 vacuum cleaners, eighty-eight electric ranges and 3,325 kitchen lighting units during the year, $3,424

SCHEDULE AND RESULTS OF BRITISH COLUMBIA ELECTRIC RAILWAY COMPANY'S MERCHANDISE ACTIVITIES DURING 1924

Date	Campaign Feature	Quota Set	Number Sold	Number of Extra Salesmen	Value of Merchandise	Broadsides Mailed	Newspaper Space	Terms: Cash Down	Terms: Balance Over, Months	Special Wiring
March 3 to 31	"Thor" washers	200	208	4	$33,218.50	30,000	$580.00	$5.00	18	.....
April 7 to 28	Miller daylight kitchen unit	4,000	3,325	22	29,422.00	20,000	1,306.14	15-day free trial, then 75 cents	10	Cost 90 cents for hanging.
May 5 to June 14	"Royal" vacuum cleaner	200	206	5	16,300.00	31,000	312.42	$1.00	15	.....
May 12 to June 30	Westinghouse and Moffat electric ranges	150	47	None	6,000.00	16,000	136.40	9.75	18	Regular price.
Aug. 8 to 16	"Vancouver exhibition" special display:									
	Washers	.....	6	None	840.00	None	123.00	5.00	14	.....
	Vacuum cleaners	.....	5	None	395.00	None		2.50	12	.....
	Electric ranges	.....	17	None	2,125.00	None		20.00	12	Special 10 per cent discount given on range wiring
Sept. 1 to 15	Westinghouse and Moffat electric ranges	60	24	None	3,266.65	1,000	297.57	10.00	16	$40 per range.
Sept. 22 to Oct. 18	Savage washers	100	58	None	10,400.00	19,000	420.00	5.00	12 to 18	.....
Nov. 17 to Dec. 24	Royal vacuum cleaners	138	132	4	10,428.00	18,000	250.00 plus equal amount by Royal Co.	2.50	15	.....

was spent in newspaper advertising; that is, 3 cents was spent in advertising for each dollar of merchandise sold during the special campaigns.

In addition to the main office salesroom, displays are maintained in six branch offices. Store sales are supplemented by sixteen outside salesmen, who operate in three groups. One group specializes on washing machines, one on vacuum cleaners and another on electric ranges. It has been found advantageous to have salesmen specialize rather than to try to sell all appliances.

During the year domestic electric refrigerators and a radio section were added to the appliances carried.

To encourage the greater use of energy by domestic consumers a rate was introduced based on floor area. For each 100 sq.ft. of floor area the rate is 5 cents for the first 3 kw.-hr. and 2 cents per kilowatt-hour for the excess. The minimum is 1,000 sq.ft., or 30 kw.-hr. at the 5-cent rate. The company feels that this rate is encouraging a freer use of electrical appliances.

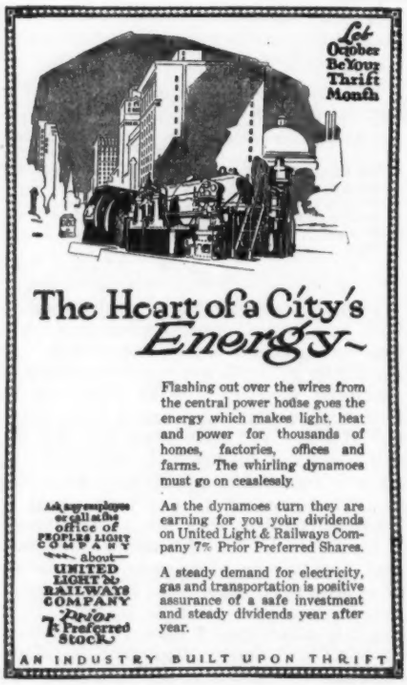
Stock Sales Show Public Confidence in Utility

BY H. E. WEEKS
Vice-President and General Manager
United Power Securities Company,
Davenport, Iowa

IN A territory then comprising 70,000 consumers, the United Light & Power Company sold during 1924 prior preferred stock to the value of $1,707,200. This was at the rate of $24 for every consumer. During the past five years stock sales have amounted to $5,000,000.

One factor responsible for full cooperation of employees has been the policy of paying the full commission to regular employees who co-operate with a full-time stock salesman in making a sale. This policy encourages employees to turn over their prospects to the full-time salesman and results in larger sales than otherwise. Full-time stock salesmen close about 80 per cent of all sales, but regular employee co-operation is responsible for initiating many of these sales. One full-time stock salesman is assigned for every 25,000 population.

Dividend checks are mailed monthly


Let October Be Your Thrift Month
The Heart of a City's Energy
Flashing out over the wires from the central power house goes the energy which makes light, heat and power for thousands of homes, factories, offices and farms. The whirling dynamoes must go on ceaselessly.
As the dynamoes turn they are earning for you your dividends on United Light & Railways Company 7% Prior Preferred Shares.
A steady demand for electricity, gas and transportation is positive assurance of a safe investment and steady dividends year after year.
Ask any employee or call at the office of PEOPLES LIGHT COMPANY about UNITED LIGHT & RAILWAYS COMPANY 7% Prior Preferred Stock
AN INDUSTRY BUILT UPON THRIFT

TYPE OF ADVERTISING THAT WAS USED IN CONTINUOUS SALE OF UTILITY STOCK

to all subscribers commencing within a month after the subscription. These dividends are paid to time payment subscribers as well as to full owners of certificates. The value of this policy lies largely in the confidence induced in the minds of subscribers when they receive a dividend check within a month of the time they purchase the stock. Partial payment subscribers are charged with interest at 7 per cent on the unpaid balance of their subscription.

At the time this monthly dividend plan was initiated the holding company whose securities were being sold was little known to the consumers of the subsidiary companies. During this initial period it was felt that the confidence of subscribers would be encouraged by this monthly dividend plan. After five years of successful sales and the distribution of $5,000,000 of the stock in the community served by the company, it is now quite possible that the monthly dividend plan could be replaced by quarterly dividends without interfering seriously with the sale of the stock. In the case of partial payment subscribers there is some expense attached to "pulling" each month the names of subscribers whose payments have lapsed. It would be easier for the accounting department merely to credit partial payment subscribers with 7 per cent interest on their payment. However, the monthly dividend plan has been so helpful in obtaining subscribers in new territory and the company has recently extended its holdings throughout so much new territory that the present plan may be continued.

MARKET MAINTAINED

A resale market has always been maintained. The stock was first sold at 100 and will be sold after May 16 at 103. A resale charge of $2 is made on all shares turned back. With a definite resale charge the subscriber knows that if he has to forego completion of his purchase or has to liquidate his holdings, he will still recover all his capital and at least 5 per cent in interest if he holds his stock for one year. Such a proposition is hard to equal in the investment field.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Operating Centrifugal Pumps in Combination.—RUSSELL K. ANNIS.—The characteristic behavior of pumps in series and in parallel is explained in simple form. The object of the article is to show how a rational selection of new equipment can be made to supplement or replace the old.—*Power*, March 3, 1925.

Principal Hydro-Electric Developments: 1924.—Statistics are given of plants completed or under construction. The total of new water brought into service amounts to 1,100,000 hp. in the United States and 660,000 hp. in Canada.—*Engineering News-Record*, Jan. 8, 1925.

Hydro-Electric Plant Has 452,500 Hp. Installed Nominal Capacity.—The Niagara Falls Power Company has recently completed a 210,000-hp. extension to its hydraulic plant No. 3, which gives this station the largest available operating capacity in the world. For short periods it could carry more than one-half million horsepower load. Many of the pieces of equipment installed are the largest of their kind that have ever been constructed. The article is illustrated and describes the engineering features down to the turbines.—*Power*, March 3, 1925.

Hydro-Electric Power as a Byproduct of Agricultural Storage.—EVERETT N. BRYAN.—The paper discusses economic and other considerations affecting the utilization of streams by means of high-head dams primarily for irrigation, but presenting also the possibility of large-scale power production. It deals specifically with conditions in the far West. Several existing and projected developments are analyzed as to water supply, needs for irrigation, available power, synchronism of output with irrigation demand, and marketing of the byproduct power.—*Proceedings of the A. S. C. E.*, January, 1925.

Generation, Control, Switching and Protection

Operation of Diesel Engines.—R. HILDEBRAND.—Various features are discussed in a series of practical articles.—*Power*, Jan. 20, Feb. 3 and 17, March 3, 1925.

Calculation and Design of Air Coolers for Turbo-Generators.—R. POHL.—Efficient methods for the cooling of air of large high-speed generators have been developed in America, and these have found entrance into European plants to some extent. The entire problem has, however, also been investigated by a large German concern, resulting in designs made along independent and somewhat different lines. The heat transmission from metal to water is known to be about forty times faster than that from air to metal. To accomplish the highest exchange of heat it would therefore be necessary to make the air-exposed surface of the cooling apparatus forty times larger than the water-cooled surface. Theoretical and practical reasons show that this maximum gradient ratio is not economical, one such reason, for example, being that the slightest sediment in the water tubes would reduce the cooling action materially. It has therefore been decided to be satisfied with a moderate rise of the heat current, using ribbed tubes with eight times the surface of the smooth tube. Such coolers will cost more, but will have less maintenance expense. In conjunction with such coolers the most satisfactory speeds of water flow and air velocity have been found to be 0.3 to 0.4 m. per second for water and 5 to 10 m. per second for the air. The coolers themselves are built like radiators, consisting of many round brass tubes, expanded at their ends into headers. The surface of these tubes is greatly increased by a large number of circular steel disks, tinned solidly to the tube. The slightly better performance of tubes of elliptical cross-section is more than counteracted by the much higher manufacturing cost of such tubes. Three, four or more such radiators are built together to form large cooling units, which are arranged with suitable shut-off valves in such a manner that any defective radiator can be changed without impairing the operation of the others. The individual tubes of each radiator, being only expanded and not welded into the headers, can be easily replaced. Examples of such cooling units are shown. The installation of these units is indicated in two typical cases. One of these shows an interesting example of a mechanically automatic change-over from water cooling to self-cooling in case of a failure in the water supply.—*Elektrotechnische Zeitschrift*, March 26, 1925.

Transmission, Substations and Distribution

Paper Insulators or Porcelain Insulators?—A. HAMM.—High-voltage insulators for transformers, switches, arresters, wall bushings, etc., made from Bakelized paper are gaining in popularity in Europe over the porcelain insulators that were formerly exclusively used. Their chief disadvantages, the author points out, are their electric unreliability due to inclosed air bubbles, which cause creepage and final flash-over; their flammability and their hygroscopic character, restricting their use to indoors. When a paper insulator fails, it will always burn to ashes, and the fire may readily spread to oil or to the building. Cases have been known where the flash-over of such a bushing was responsible for the destruction of an entire substation. The author recommends the exclusive use of porcelain up to 110 kv. Where very large energies are being handled, such as in tie-in stations for several 10,000 kw. or even 100,000 kw. plants, the puncture of a porcelain insulator may cause an explosion like shrapnel, endangering the personnel. In such case a paper type would be preferable.—*Zeitschrift für Hochfrequenztechnik*, Vol. 25, No. 1, 1925.

Mechanical Characteristics of Transmission Lines. III.—L. E. IMLAY.—The present installment of this serial, which deals with the design of lines, first derives a formula for sag, on the assumption of a parabolic curve, in terms of unstressed length of cable, span, modulus of elasticity, cross-section and unit weight, then takes up the problem of the span with supports at different levels. In the matter of clearances for long spans the author holds that ample clearance will probably be provided if the spacing is increased 30 per cent for each 100 per cent increase in length of span. He gives spacings used on a number of representative lines worked at various voltages from 33 to 220 kv.—*Electric Journal*, March, 1925.

Units, Measurements and Instruments

Temperature Errors in Induction Watt-Hour Meters.—I. F. KINNARD and H. T. FAUS.—The first part of this paper deals with the general problem of small errors due to temperature changes in the meters. Curves show the magnitude of these errors, which may in extreme cases amount to more than 2 per cent and which vary with the power factor also. The causes are analyzed and the effects segregated. The chief of these seems to be the change of flux of the control magnet. This decreases with rising temperature, the coefficient being about 0.0003 per deg. C. Other errors, arising chiefly at low power factors, are due to change in resistance of potential windings, change in iron losses in the potential element and change in resistance of the lag plate. A method of compensating for the effect of changes in the control magnet is proposed—a shunt of varying permeability dependent on the temperature. Such a material is described in the second part of the paper. It is a copper-nickel-iron alloy to which the name "thermalloy" has been given. The important property of this metal is the almost linear relation between permeability, which is of the order of magnitude of 40, and temperature. Changes in characteristics are obtainable by changing the composition or treatment.—*Journal of the A. I. E. E.*, March, 1925.

Six-Element Portable Oscillograph.—J. W. LEGG.—A relatively light and compact instrument has been made possible by the development of a new steel of extraordinary magnetic properties. The description is accompanied by circuit diagrams, views and the reproduction of an oscillogram showing six quantities simultaneously.—*Electric Journal*, March, 1925.

Illumination

Manufacture of the Edison Mazda Lamp.—HENRY SCHROEDER.—This revised bulletin, taking the place of an earlier one on the same subject, describes modern methods of lamp manufacture.—*Bulletin L. D. 119D, Lighting Data*, Edison Lamp Works.

Luminescence or Cold Light.—W. S. ANDREWS.—Dividing manifestations of luminescence into classes according to their causation by incident light, cathode rays, electrical stimulation, heat, stimulation of vapors by flame,

chemical action, and friction or abrasion, the author discusses each class and gives examples of some of the more striking cases. A full-page table summarizes information about more than a score of substances giving the source of excitation, color and duration of phosphorescence.—*General Electric Review*, February, 1925.

Motors and Control

Synchronous Motor Drive for Rubber Mills.—C. W. DRAKE.—Rubber-mill drives impose two severe conditions upon the motor equipment, first, a high starting torque when the mills are started with rubber in the rolls and, second, a quick stopping in case of an emergency. The author shows that these can both be met by the synchronous motor, which has, in addition, other features making its use desirable in rubber mills. Using the 80 per cent tap of the starting transformer a torque of one to one-and-a-half times full-load torque is obtainable. This is found to be sufficient. Dynamic braking is used for stopping. Oscillograms indicate a stop in 6¾ in. of rolls traveling at the rate of 100 ft. a minute.—*Journal of A. I. E. E.*, April, 1925.

Elevator Operation with Alternating-Current Power Supply.—C. C. CLYMER.—When elevator service is required in a building located in a district served by direct current there is no excuse for using anything but direct-current elevator engines. Where alternating current only is available conversion may be used where the highest grade of service is essential, notwithstanding the higher cost. Otherwise alternating-current machines will be used. Various types are reviewed and their characteristics discussed in detail. It is shown that, as to starting torque, with a given horsepower rating the high-resistance squirrel-cage motor has about 20 per cent advantage over the slip-ring motor, but if the maximum load has to be hoisted only occasionally, the latter will produce less line disturbance. The problem is analyzed in the light of numerical examples and characteristic motor curves. Polyphase adjustable-speed commutator motors have suitable torque characteristics for starting and regenerative ability for preventing overhauling, and have been used in Europe, but so far have not found favor in this country, on account of the complications involved by the brush-shifting mechanism. — *General Electric Review*, February, 1925.

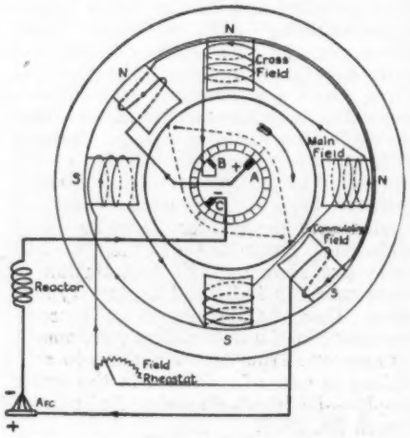
Electrophysics, Electrochemistry and Batteries

Electrolytic Preparation of Phenylenediamine, Aminosalicylic Acid, Succinic Acid and Hydrocinnamic Acid.—JAMES F. NORRIS and E. O. CUMMINGS.—Details are given for the production of the substances named. The yields found by experiment range well up toward 90 per cent or over that figure, with current efficiencies somewhat lower. The studies were made in part to determine if methods could be developed for large-scale production. In one case the conditions worked out are stated to be such that the process could be used industrially. — *Industrial and Engineering Chemistry*, March, 1925.

Heat Applications and Material Handling

Electric Dog and Taper Device for Sawmill Carriages.—J. J. TALLMAN and C. A. BINNS.—This device has been designed to eliminate the manual labor, both expensive and hazardous, of handling logs while on the carriage. The article describes and illustrates its operation. Induction motors of 2.2 and 2.8 hp., respectively, furnish the power, and one operator seated behind the three master drum reversing switches controls the entire action.—*General Electric Review*, February, 1925.

Self-Exciting Generator for Arc Welding.—H. R. MCKEAN.—By splitting the field, using armature reaction and installing a third brush a constant voltage is obtained for self-excitation, while the arc voltage decreases as the current increases, so that the characteristic resembles that of a separately excited, differentially compounded machine. The slope of this characteristic is adjustable by shifting the brushes. Wide commutating poles are used to cover the arc of brush shift, and an external reactor stabilizes the current. The circuits are shown in the accompanying illustration. The article includes views of the set, characteristic curves and oscillograms of voltage and current. — *General Electric Review*, February, 1925.



ELECTRICAL AND MAGNETIC CIRCUITS OF ARC-WELDING GENERATOR

Alternating-Current Arc Welding.—O. WUNDRAM.—Arc welding with alternating current seems to be slowly gaining ground in Europe, but opinions on this method are still unsettled. At a recent welding meeting the following facts of alternating-current welding were recorded: Over-all efficiency of this method is from 65 to 85 per cent, as against 50 to 65 per cent for direct-current welding. The investment cost is only 30 to 50 per cent of the cost for direct-current equipment. A welding transformer operates rarely with a power factor above 0.35, and striking the arc causes considerable voltage fluctuation in the network. Only coated electrodes can be used to advantage, and the arc must be short, which makes welding not as easy as with direct current. The metallurgical character of both kinds of welds is about the same, although this point needs further investigation. If carefully executed, both welds should be equal in every respect, with a decidedly higher electrical efficiency for the alternating-current method.—*Der Elektrische Betrieb*, March 24, 1925.

Electrical Cooking.—HALFDAN STEEN-HANSEN.—The author gives a criticism of the figures previously given in an article on the same subject by P. Haukas (*Teknisk Ukeblad*, Nov. 11, 1924). *Teknisk Ukeblad* (*Norwegian*), March 6, 1925.

Traction

Control Equipment for Motor and Trail Cars on the Java State Railways, Dutch East Indies.—FRANK GUILLOT.—The cars, weighing forty-two tons, are designed for operation singly or in trains, each motor car being equipped with four 115-hp. 750/1,500-volt motors with electro-pneumatic multiple-unit control. Direct current at 1,500 volts is used. The unusual feature, from the standpoint of American practice, is the use of dynamic braking, its rate being limited by a relay that prevents further motion of the controller until the current has fallen to a predetermined value. Diagrams of connections, calculated and measured speed-time curves during acceleration, current and voltage curves during braking, and views of the equipment, accompany the description.—*General Electric Review*, February, 1925.

Miscellaneous

International Progress in Electrical Power Consumption. — II. London, Paris, Berlin and Chicago.—The first installment of this statistical study took countries as a whole. This is a continuation, with more attention to individual cities. In Paris the plant capacity has changed from 225,500 kw. with ten companies in 1918 to 746,700 kw., mainly in a few large stations, with three companies in 1922, and at present the city has the most efficient system of power distribution and supply in Europe. London in 1919 had seventy-five undertakings with seventy-five stations of 390,000 kw. total, and in 1922 the supply came from eighty-five undertakings with eighty-two stations of 570,692 kw., only one of them of more than 40,000 kw. Berlin has also gone to the superpower station for much of its supply. The 1923 output in the three cities is shown in the table.

POWER OUTPUT OF THREE EUROPEAN CITIES DURING 1923

Municipality	Population	Units Generated (Millions of Kw.-Hr.)	Production per Capita (Kw.-Hr.)
London	8,250,000	1,345	163
Paris	3,500,000	1,500	430
Berlin	3,750,000	1,200	320

The comparison with American cities is still more striking. In the near future Chicago, with 2,700,000 inhabitants, will have 752,000 kw., or more than one-fourth of the total plant in Great Britain, with its population of 43,000,000. Space does not permit quoting the data on selling prices of energy. Throughout the author calls attention to the unfavorable conditions in England.—*World Power*, February, 1925.

News of the Industry

Southwestern Convention a Model One

N. E. L. A. Men and Utility Executives Unite in Achieving Success for Joint Gathering at Hot Springs, Ark.— Enthusiastic Spirit Evident

THE joint convention of the Southwestern Geographic Division of the National Electric Light Association, embracing Mississippi, Louisiana, Texas, Arkansas and Oklahoma, and of the Arkansas Utilities Association at Hot Springs, Ark., April 21 to 24, briefly noticed in these columns last week, was the most successful ever held in that section. It was regarded by the officials of the national organization as among the best held by any division, and in the character of attendance, balance of program and general features a model worthy of emulation. Certainly for spirit, attendance and enthusiasm the Hot Springs convention established a record.

J. F. Owens of Oklahoma City, in his address as president of the division, called attention to the accomplishments of the electric public utilities of the country and to the dangers inherent in the very popularity of their securities and the favorable public relationships established in that they offered opportunity to the private adventurer to capitalize them to his profit. He also admonished his hearers to greater alertness, greater effort and increasing vigilance in maintaining the proud position of the electric public utility industry.

President Griffith's Address

President Franklin T. Griffith of the national organization said the electric light and power industry is the most rapidly growing one in the world and that the best proof that its executives are good administrators is the fact that the industry is able to secure funds necessary for the phenomenal expansion of the business. Much of the agitation for government ownership in this country being predicated on the alleged success of the Hydro-Electric Power Commission of Ontario, President Griffith dwelt at some length on the record made there and showed how exceptionally tender the Ontario commission is in its treatment of those who through sheer weight of numbers can determine whether or not the experiment should continue.

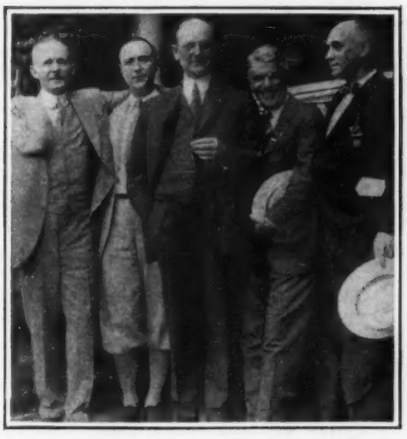
M. H. Aylesworth, managing director of the National Electric Light Association, also fired a broadside against government ownership and discussed the problems of farm electrification.

A further amplification of the latter theme was made at a later session by Dr. E. A. White of Chicago, director of the Committee on the Relation of Electricity to Agriculture. According to Dr. White it would cost $1,500,000,000 to electrify half of the farms of the United States, but if agriculture is to keep step with national progress a solution must be found by the industry.

Dr. White took occasion to complain that many central-station companies have adopted a negative mental attitude toward rural electrification and are not doing their share in solving the problem. The question is not what the farmer can afford to pay—he will decide that in the final analysis—but the price at which the utility company can afford to sell to him.

W. H. Hodge of the Byllesby organization of Chicago made an interesting address on advertising, stating that advertising is just as essential to the success of public utilities as the work of the engineers.

A feature of the convention program was the part set aside for the women. On Thursday morning the greater part of the session was given over to a debate on the question," Resolved, That women in public utility service are more effective in their contact with the public than are men." Miss Jane Scherer of Beaumont, Tex., won the debate for the affirmative. Following the debate, Miss Helen Steiner of Lorain, Ohio, gave further proof of the efficacy of women in handling certain phases of public utility work.



Prominent Delegates Are Snapshotted

Left to right—J. F. Owens, Oklahoma City, retiring president Southwestern Division; M. H. Aylesworth, New York, managing director N. E. L. A.; F. T. Griffith, Portland, Ore., president N. E. L. A.; Gil Cotton, Hot Springs, Ark., and S. J. Ballinger, San Antonio, secretary Southwestern Division. (Photo by Alta Smith, Hot Springs.)

Two other speakers dwelt on weightier matters in the industry at Thursday's session. W. H. Onken, Jr., of the ELECTRICAL WORLD addressed the gathering on the "Outlook for the Electrical Industry," and C. F. Hirshfeld of the Detroit Edison Company spoke on "The Technical Section." Mr. Onken's address was replete with statistics of the industry and he showed how eleven systems supply one-third of the energy of the country and how two operators between them control one-fifth of the business. Speaking of the opportunities, Mr. Onken was most optimistic, but said the industry, if it would grasp them, must envisage more than the slide rule and machinery and must be animated by a sincere spirit of service and a desire to help mankind.

H. L. Nichols of William S. Ross & Company, Chicago, in his address on "Financing the Public Utility," given at the closing session, stressed the necessity of utility companies keeping a clean house in accounting and cited the Oklahoma Gas & Electric Company as a glowing example of firm financial structure. With the adoption of well-recognized standards in construction, accounting and financing, a utility company has almost a guarantee of success, Mr. Nichols said.

Another speaker at the closing session was H. C. Spillman, educational manager of the Remington Typewriter Company, whose address on "Adjusting Ourselves to a New Era in Business" was very well received. Mr. Spillman stressed the necessity for individual thinking and development of new ideas, stating that the most important thing in business is not the rise and fall of the stock market, but the rise and fall of constructive thought.

The afternoon sessions were given over to committee reports. Entertainment in abundance was afforded the delegates, some unusually interesting diversions being supplied by Earle W. Hodges, director of the Arkansas Public Service Information Bureau.

Officers for Coming Year

Officers of the Southwestern Geographic Division, N. E. L. A., were elected as follows: President, C. J. Griffith, Little Rock, vice-president Arkansas Central Power Company; vice-president from Louisiana, H. B. Flowers, New Orleans; vice-president from Mississippi, E. E. Armstrong, Hattiesburg; vice-president from Texas, J. G. Holtsclaw, Beaumont; vice-president from Oklahoma, Fred Insull, Tulsa; vice-president from Arkansas, J. L. Longino, Pine Bluff; treasurer, W. J. Tharp, Little Rock; secretary, S. J. Ballinger, San Antonio.

For the Arkansas Utilities Association these officers were elected: President, Robert C. Coffy, vice-president Fort Smith Light & Traction Company; first vice-president, S. R. Brough, Little Rock; second vice-president, F. M. Wilkes, Pine Bluff; secretary-treasurer, R. I. Brown, Little Rock.

Next year's convention of the Southwestern Division will be held at Dallas, Tex.

Welding Engineers Meet

Importance of Proper Supervision and Methodical Tests of Work Is Emphasized

A VALUABLE symposium on the methods employed by various industries in inspecting their welding work and in appraising and testing the skill of their welding operators was presented at the annual meeting of the American Welding Society in New York last week. About twenty-five engineers from a wide variety of fields summarized the welding practices employed in their particular industry. Much authentic information as to the methods now employed in inspecting welds and testing the skill of operators in production work, general repair work, pressure-vessel welding, pipe welding, tank welding, rail jointing, etc., was made available.

A very complete account of the welding of rail joints was given. On the Chicago Surface Lines an organization has been set up for instructing operators, and good work has resulted from following these instructions with proper inspection and testing. An interesting part of the system is the regular meetings at which all division superintendents, welding foremen and welding operators are present. In the discussions that take place at these meetings many pertinent points are brought out. Instructions are issued covering future work, and the operators are brought in touch with one another's work, samples of welds, test pieces, etc., being brought into the meeting.

IMPORTANCE OF SUPERVISION

One engineer pointed out that the competent supervision of welding operators was a more important matter than the initial skill of the welders, for good supervision insures proper methods and eventual good work. In his opinion the entire responsibility of obtaining good welding should be placed on the supervisors.

How to increase the ductility of welded rail joints and other welded joints subjected to shock was discussed by several speakers. It was brought out that where failures have occurred the weld metal very often has not been ductile enough to stretch and relieve the strains, and cracks have developed which extend as the joint is used. Experience on test pieces has shown that if the weld metal is annealed from the critical point down slowly its ductility will be improved. In most cases it is impracticable to do this. The best way to get ductile metal in the weld in the present state of the art was thus summarized: A good, conscientious, experienced operator who has been trained, a short arc and proper fusion of the surfaces, a good wire not over $\frac{1}{8}$ in. in diameter and the thorough cleansing of the parts to be welded from dirt and thick rust.

Much progress in committee work was reported. Probably within the next six months the testing of arc-welded ship plates will be completed. These tests are being conducted to determine certain fundamentals of electric arc welding as they are affected by various currents, angles of bevel, number of layers of deposited metal, size of electrode, etc. The ship plates are being tested for tensile strength, bending and fatigue.

A committee has been working during the past year on the welding of copper, brass and bronze. So far the investigation has been confined mainly to physical characteristics, but further work is contemplated which will be reported at the next meeting of the society.

Montreal Company Again Lowers Its Retail Rates

The Montreal Light, Heat & Power Company, which maintains that its averaged rates are lower than those of the Ontario Hydro-Electric Power Commission, has reduced its retail rate for lighting to 3½ cents per kilowatt-hour. In February, 1924, it was cut from 4¼ cents to 4 cents. The new rate is one-fourth of that charged when electricity was first introduced in Montreal. Large monthly light consumers now get a rate of 2½ cents per kilowatt-hour. The new rate for electric stoves is 2½ cents with a minimum charge of 50 cents per month per element. The company paid an income tax of $721,151 to the Dominion government on April 30, covering its business for 1924. Its income tax for 1923 was $650,000. In a statement pointing out that publicly owned electric enterprises in Toronto, Winnipeg and other places are not subject to the Dominion income tax, Vice-president J. S. Norris says:

"This income tax, which the consumer really pays, represents 22 per cent of the company's retail electric lighting business; in other words, if there were no income taxes to pay, our new retail rate of 3½ cents per kilowatt-hour could be reduced to 2.7 cents."

Yearly Tax for Excess Water at Niagara Put at $60,000

The New York State Water Power Commission met this week and fixed a rental of $60,000 a year as the state's proper income from diversion of state-reserved waters at Niagara Falls by the Niagara Falls Power Company. The commission also imposed a retroactive rental charge from March, 1922, to January, 1925, of $120,000. The case has been before the commission for determination since 1921. It will be remembered that the outgoing Democratic commission last fall made a tentative offer to the Niagara company to put the rate at 50 cents per horsepower, which, it was then stated, would have amounted to about $45,000 per year, the offer being conditioned on a pledge that no part of the rental should be passed on to the consumers. This offer was not accepted by the company, and the present rental price is fixed without stipulation as to where the money is to come from.

Alexander Macdonald, Conservation Commissioner and chairman of the Water Power Commission, said after the meeting that the rental had been imposed as provided by statute and that the Public Service Commission is the proper authority to determine whether the rental is to be passed along to the consumer in increased rates. It is the general impression at Albany that the power company will accept the terms of the Water Power Commission.

Still Nothing Done at Muscle Shoals

War Department Begins to Chafe About Delay—Subnormal Rainfall in Southeastern States Makes a Speedy Decision Important to That Section

SOME impatience is manifested at the War Department because of the delays which are preventing a definite arrangement for the disposition of the power to be developed at Muscle Shoals. The advertisement calling for bids was drafted more than a month ago. The engineers particularly recognize that arrangements must be made in advance to handle large blocks of power. They are about to complete the construction work and they are anxious to turn the properties over to some responsible interest to operate.

Acting Secretary of War Davis emphasizes the point that it is the desire of the department to co-operate with the Muscle Shoals Commission and that he will be disposed to wait a reasonable time for any recommendation it may care to submit. He said, however, on April 27 that he had had no indication from the commission as to when its recommendation would be forthcoming. At the offices of the commission on April 28 it was stated that no meeting of the commission had been arranged. The report that the commission will visit Muscle Shoals in the near future is denied at the commission's offices. It is understood, however, that Commissioners McClellan and Dial will go there soon to look over the properties.

The situation in the Southeast is such that there is great demand from that section for a definite understanding. The rainfall during the winter months was 65 per cent of normal. The industrial prosperity of that section has been such during the same period as to call for more than normal supplies of power. As a result the power companies are going into the dry season with little more than 50 per cent of the head in their reservoirs that they normally would have at this season of the year. They have been forced to call their steam reserves into action at a much earlier date than usual. In this connection it also is pointed out that much of the steam reserve is anything but modern and cannot be relied upon to furnish its rated capacity. These plants have not been modernized because of the prospect that they would not be needed when power would become available at Muscle Shoals.

Colonel Spaulding, in charge of the work at Muscle Shoals, has made another trip to Washington. He reports that he is going ahead as rapidly as possible with the construction of the high-voltage line from the dam to the steam plant.

Boston Rate Case Up

Street-Lighting Contest with the City Is Adjusted—Company's Proposals Affecting Domestic Tariff

THE Edison Electric Illuminating Company of Boston and the city of Boston have adjusted the dispute regarding rates for street lighting, one phase of the rate contest which has for so long been before the Massachusetts Department of Public Utilities, and the joint petition filed with the department by the company and the city in 1920 has been withdrawn.

With respect to the general case, affecting the rate for ordinary house lighting, Counsel Ives, the company's representative, says that as it has not been shown that the company's plant account is inflated, its expenses excessive or its return improper, it follows, if its prognosis regarding 1925 is correct, that it cannot reduce its revenues and continue to earn the modest return it is now earning and at the same time set aside 2 per cent for depreciation in 1925. Nevertheless, he points out, the commission may effect some reduction in the "A" rate by requiring a discontinuance of the lamp service or by reducing the rate in some communities and increasing it in others.

Continuing, he says in his brief: "If, however, the commission is of the belief that a reduction in the 'A' rate will result in increased business which will compensate for the loss in revenue, and if it should be right in that belief, or if it is of the opinion that provision for depreciation in 1925 may be postponed so that it may be made up in later years, it would be possible for the company to make a reduction in the 'A' rate." In such event, the document says, a cut of half a cent per kilowatt-hour in the retail rate would affect about 200,000 customers and mean a loss in revenue of approximately $500,000 a year.

Mr. Ives says further that if the commission, appreciating that provisions for depreciation might properly be postponed, should recommend a reduction along the lines suggested a year ago by the city of Boston and the Boston *American* and agreed to by the company, the company is still ready to give such reduction a trial. That proposition contemplated reduction in the maximum rate by half-cent cuts every six months until the rate became 8 cents per kilowatt-hour.

Final arguments in this rate case were heard by the commission beginning April 27.

Rhode Island Merger Effected

By the formation of the South County Public Service Company the three subsidiary companies of the Narragansett Electric Lighting Company of Providence which operate at present in southern Rhode Island have been merged. These are the Westerly Light & Power Company, the Narragansett Pier Electric Light & Power Company and the Wickford Light & Water Company, now having executive offices at Westerly. Concerning this merger President Barrows of the Narragansett company said this week: "Through this consolidation economies will be brought about by a concentration of purchasing, bookkeeping and maintenance of line crews, with the result that we shall be able to reduce our lighting rates about one cent per kilowatt-hour, an annual saving to the customers of about $12,000. Application will be made immediately to the Public Utilities Commission in order that this new rate may be placed in effect at the earliest date."

The following officers were elected for the ensuing year: William Clark, president; Edwin A. Barrows, vice-president; Franklin L. Hall, secretary and treasurer; Leslie F. Mowry, assistant secretary and treasurer; William C. Clarke, general manager. The companies will continue to operate branch offices and electric shops in Wakefield and Wickford.

Charles E. Hughes on Government and Industry

In an address before the Chamber of Commerce of the State of New York last Tuesday evening, Charles E. Hughes, ex-Secretary of State, said:

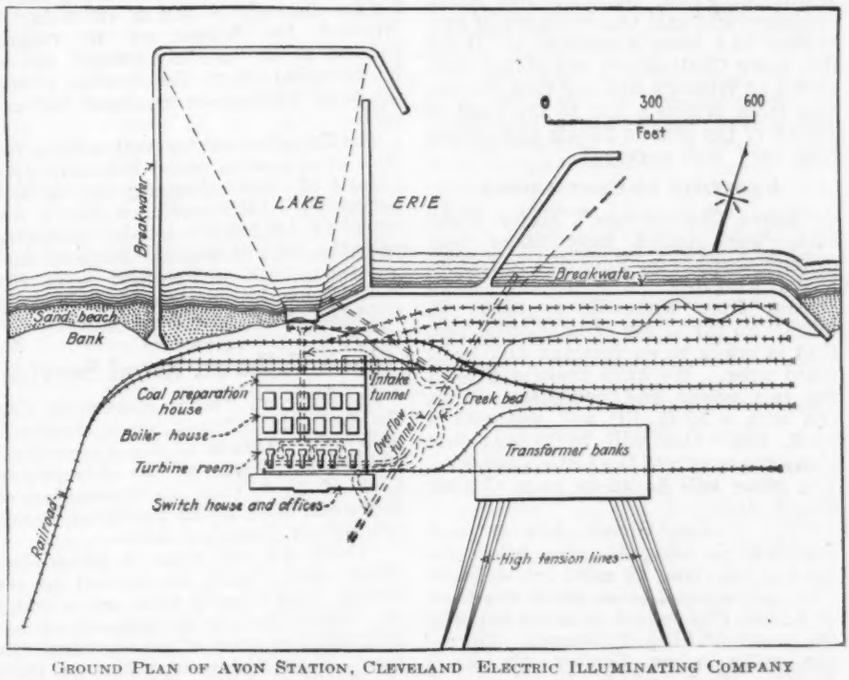
"I know there are some who think that our government does not espouse with sufficient ardor the cause of business expansion abroad, that it is a mistake to withhold desired assurances of support when American interests seek opportunities in other lands, and other governments are held up to us as patterns of the sort of governmental enterprise and backing which would assure success in a world competition. I think that this is a shortsighted view. Our policy rests on the conviction that, given an equal opportunity abroad, fair and equal dealing, American business men can take care of themselves. It is because of this policy that American capital is welcomed in many countries needing development, because it is believed that business enterprises sponsored by our business men are not associated with governmental intrigue. Our government does not play favorites among American business men."

Avon Station Begun

Cleveland Company's New Plant Will Have Initial Rating of 67,500 Kw.

WORK started last month on the superpower plant that the Cleveland Electric Illuminating Company is to build at Avon Beach, 5 miles east of Lorain and 23 miles from Cleveland's Public Square. This station will eventually contribute 300,000 kw. to production in "Greater Cleveland" and adjoining territory. It will be connected with the Lake Shore station by a belt line surrounding Cleveland and, like Lake Shore, will tie in with the transmission system which extends over Ohio, western Pennsylvania, West Virginia and eastern Indiana. Pulverized fuel will be burned.

The station and its auxiliary equipment will cover approximately 28 acres of land, including what formerly was Avon Beach Park, lying between Lake Road and the lake shore. It will be two-thirds the ultimate size of the plant. The plant proper will include, from north to south, a coal hopper or receiving house, a coal preparation house, a boiler room to house twelve pulverized-fuel boilers, a turbine room to accommodate six turbo-generators, a switch house and offices. The boilers will be similar to those in the east unit of Lake Shore station. Each pair of boilers will be surmounted by a stack rising 175 ft. above the roof of the station. There will be storage facilities for more than 100,000 tons of coal.



GROUND PLAN OF AVON STATION, CLEVELAND ELECTRIC ILLUMINATING COMPANY

The furnaces will superheat the steam to 735 deg., developing a steam pressure of 400 lb. to the square inch. Each boiler will normally generate 3,060 hp. and will be capable of operation at three times that rating. The initial installation will consist of four boilers and two turbo-generators, each of which will develop 33,750 kw. Near the eastern end of the property a transformer substation will step up the current from 11,000 volts to 132,000 volts.

Developing the Tennessee

Studies Are Taking Definite Shape, and Congress Appropriates $315,000 More

A LAST-MINUTE appropriation by the late Congress of $315,000 to continue the government survey of the Tennessee River and its tributaries was hailed with satisfaction in the large Southern territory watered by that stream. The survey contemplates converting the Tennessee and parts of its tributaries into navigable streams and along with this plan to make it possible to utilize the vast water power now going to waste.

It was asserted at the hearing before the rivers and harbors committee of the House that the building of the contemplated dams would develop 3,000,000 hp. and make the Tennessee River ultimately navigable from Paducah to a point 4 miles above Knoxville, a distance of 625 miles. This statement, made by Willis G. Waldo of Chattanooga, engineer for the Tennessee River Improvement Association, was supplemented by testimony from Major Harold C. Fiske, United States Army engineer, who said that his work of surveying had been completed at Hales Bar below Chattanooga and almost completed at Widow's Bar and that the section from Widow's Bar to the head of Pool 3 of the Muscle Shoals section had been very well surveyed.

KNOXVILLE TO CHATTANOOGA

"Above Chattanooga," Major Fiske said, "our studies have taken very definite shape from Knoxville to 7 miles above Kingston. The distance down stream from Knoxville is about 75 miles. So far as my office is concerned, that is ready to go forward and to be acted upon. We have there a project for two power and navigation dams, one with a 53-ft. lift and one with a 36-ft. lift. One will be located just above the mouth of the Little Tennessee. The other will be at or near Coulter Shoals dam.

"The Coulter Shoals dam is best described as being 44 miles below the head of the river, 40 miles below Knoxville, and about 7 miles above the town of Lenoir City, which is about opposite the mouth of Little Tennessee. Thirty-one miles below Coulter Shoals is Marble Bluff, which is about 15 miles below Loudon and 7 miles from Kingston."

Major Fiske said that when the second dam, the Marble Bluff dam, is built immediately below Coulter Shoals, it will form a basin in the interest of navigation, and this will make it possible to shut down the plant at Coulter Shoals about twelve hours a day. In that way Coulter Shoals will be operated at double capacity twelve hours a day, the normal working day. If that is done, he said, 28,000 twelve-hour firm horsepower can be developed at Coulter Shoals and 14,000 twenty-four-hour firm horsepower at Marble Bluff, which combined makes 42,000 hp.

The cost of these dams, Major Fiske said, is estimated at $12,000,000. He said that responsible companies stood ready to take over this work as it now stands and carry it on to completion.

"In addition," said Major Fiske, "we are also doing work on Clinch River, which, it is anticipated, will give very large storage and power." To complete these projects would give Muscle Shoals about twice its present primary horsepower, increasing it to 200,000 primary and 400,000 secondary horsepower.

Exporter of Canadian Power to Pay the Tax

While the full regulations governing the tax recently imposed by the Canadian government on exports of electricity have not been announced yet, it was stated in the House of Commons on April 23 by the Minister of Trade and Commerce that the exporter would be obliged to pay the tax. An order in council covering this regulation provides that monthly returns of power exported accompanied by a check for the amount of the duty thereon must be made. The order provides that exporters of power shall send such returns, accompanied by the meter readings on which they are based, every month to the government and shall compute their tax and inclose a check for the amount. A fine of $50 a day is imposed for failure so to report. Figures in the monthly returns are to be compiled from the figures giving the total kilowatt-hour output for export.

The Canadian government returns for the eleven months ended February give exports of electrical energy during that period as 1,138,911,685 kw.-hr., a decrease of 139,180,598 kw.-hr. compared with the 1923-24 period. Exports during the month of February were 79,259,775 kw.-hr., compared with 101,936,082 kw.-hr. in February, 1924.

Sloan Talks on Rural Service

Speaking on "What Electricity Can Do for Agriculture" at a luncheon under the auspices of the Agricultural Publishers' Group of the Advertising Club of New York on Wednesday of this week, M. S. Sloan, president Brooklyn Edison Company, said:

"There are two ways in which electrical service may be carried to the farms. One is being tried out in Ontario, where there is government ownership and operation of the electrical system. There the construction of farm service lines is heavily subsidized by the government. The other way is the extension of farm service as a sound business proposition with all elements carefully weighed, which is what we are doing here—the furnishing of service where and when and as it can be made to be mutually advantageous to the farmer and the electrical company.

"The part the electrical industry has to perform in this situation is to aid the farmer in ascertaining the most advantageous applications of electricity to his work and to get the electricity to him. We are undertaking that, not from a spirit of altruism and yet not for profits alone. We are co-operating with farmers' representatives to solve the technical problems of engineering, of financing, of rates, because we know we have imposed on us the duty of making electrical service as widely available as is economically possible."

Electrolysis in Chemistry

Its Application in the Production of Aluminum and Other Metals Topic of Electrochemists

MORE than three hundred members and guests registered for the forty-seventh meeting of the American Electrochemical Society at Niagara Falls, N. Y., on April 23, 24 and 25. Headquarters were at the newly completed Hotel Niagara. The principal feature of the technical session was a symposium on the production of metals by the electrolysis of fused salts, this being the process by which such metals as aluminum, magnesium, beryllium, zirconium and cerium are obtained. The symposium was under the direction of W. G. Harvey, vice-president of the American Magnesium Corporation. Dr. Frary of the Aluminum Company of America described for the first time the method of preparing aluminum 99.98 per cent pure. A round-table discussion on teaching electrochemistry, under the direction of Prof. O. P. Watts of the University of Wisconsin, attracted a large attendance and was participated in by leading educators and industrialists.

Among the features of popular interest was an illustrated lecture on amateur cinematography by Dr. C. E. K. Mees, director of research for the Eastman Kodak Company. Dr. C. G. Fink gave a brief illustrated talk on his electrochemical method of restoring ancient corroded bronzes.

At the annual business meeting the following officers were elected: President, F. M. Becket; vice-presidents, William Blum, F. C. Frary and E. F. Cone; managers, H. W. Gillett, F. N. Speller and J. W. Bain; treasurer, Acheson Smith; secretary, Colin G. Fink. The council appointed H. C. Parmelee, editor of *Chemical and Metallurgical Engineering*, as the society's representative on the National Research Council for the ensuing three years. The next meeting of the society will be held at Chattanooga, Tenn., September 24, 25 and 26. Its technical feature will be a symposium on the electrochemistry of fertilizer materials.

American Physical Society Meets in Washington

At the regular spring meeting of the American Physical Society at the Bureal of Standards, Washington, on April 24 and 25, seventy-one papers were presented or read by title. As usual, electronic papers predominated both in number and in the amount of interest aroused. The epoch-making work of the Braggs on X-rays and crystal structure is still bearing fruit as evidenced by the number of investigations presented at the meeting. The quantum theory and the Bohr atom formed the basis of papers in connection with electronic orbits, energy levels, spectra, ionization, etc. Several papers were presented on the correlation between spectra and atomic structure. Thermionic emission and the photoelectric effect received attention.

A number of experimental studies on mechanical properties of solids and liquids were reported, such as stress-

strain diagrams, viscosity and internal friction, behavior under impact, etc. There were also a few papers on electric and thermal conductivity, specific heat, capacitance, piezo-electric effect and other familiar quantities. A learned paper was presented on Heaviside's theory of electric networks, explaining some discrepancies in practical applications and giving a more rigid criterion of validity. As was to be expected, there were several papers reporting electric, magnetic and illumination measurements on the recent solar eclipse.

At an informal dinner on Friday night Dr. Irving Langmuir made a plea for an institution of learning in this country patterned after those German universities where studies are optional and eclectic.

A. I. E. E. Regional Meeting at Swampscott

As already announced, the second regional meeting of the Northeastern District, A. I. E. E., will be held at the New Ocean House, Swampscott, Mass., May 7, 8 and 9. The Lynn Section will be host. Following is the technical program:

THURSDAY, MAY 7

Morning.—Transmission Problems: "Overvoltages on Transmission Systems Due to Dropping of Load," E. J. Burnham, General Electric Company; "Sleet and Ice on Transmission Lines," C. R. Oliver, New England Power Company; "Electromechanical Problem Analyzer," C. A. Nickle, General Electric Company; "Losses in Iron Under the Action of Superimposed Alternating-Current and Direct-Current Excitation," J. E. Jackson, Alabama Power Company, and O. E. Charlton, General Electric Company.

Afternoon.—Electrical Apparatus: "Tap Changing Under Load," H. C. Albrecht, Philadelphia Electric Company; "Voltage Control Obtained by Varying Transformer Ratio," L. F. Blume, General Electric Company; "Changing Transformer Ratios Without Interrupting the Load," M. H. Bates, General Electric Company; "Universal-Type Motors," L. C. Packer, Westinghouse Electric & Manufacturing Company; "A Two-Speed Salient-Pole Synchronous Motor." R. W. Wieseman, General Electric Company; "Short-Circuit Currents of Synchronous Machines," R. F. Franklin, General Electric Company.

FRIDAY, MAY 8

Morning.—Cables and Education: "Cooperative Course at the Massachusetts Institute of Technology," Prof. W. H. Timbie, M. I. T.; "Oil-Filled Terminals for High-Voltage Cables," E. D. Eby, General Electric Company; "Cable Joints," E. W. Davis and G. J. Crowdes, Simplex Wire & Cable Company; "Effect of Repeated Voltage Application on Fibrous Insulation," F. M. Clark, General Electric Company; "Education in Industry," S. W. Ashe, General Electric Company.

SATURDAY, MAY 9

Morning.—Measurements: "Calibration of Wave Meters," J. A. Stratton and James K. Clapp, Massachusetts Institute of Technology; "Predetermination of Self-Cooled, Oil-Immersed Transformer Temperatures," W. H. Cooney, General Electric Company; "Studies of Time Lag of Needle Gaps," K. B. McEachron and E. J. Wade, General Electric Company; "Recent Improvements in Alternating-Current Indicating Instruments," S. H. Hoare, General Electric Company; "Measurement of Electrical Output of Large Alternating-Current Turbo-Generators," E. S. Lee, General Electric Company; "Temperature Errors in Induction Watt-Hour Meters," I. F. Kinnard and H. T. Faus, General Electric Company.

There will be inspection trips and recreation on Friday and Saturday afternoons and Thursday evening. On Friday evening an informal dinner will be held, when Dr. Elihu Thomson and Johnson O'Connor of the West Lynn works of the General Electric Company will speak.

Technical Men at Spokane and Fresno

Northwest Association's Engineering Section Discusses Topics Now Uppermost

THE influence of power systems on radio reception, the application of electricity to logging operations, accident prevention and underground distribution systems were among the subjects that brought forth discussion at the two-day general meeting of the Technical Section of the Northwest Electric Light and Power Association at Spokane, Wash., on April 16-17. This meeting was the second annual gathering of the section, and the attendance of 120 delegates and visitors exceeded last year's by 38 per cent.

In reporting for the committee on inductive co-ordination, G. E. Quinan, chief electrical engineer Puget Sound Power & Light Company, said that the principal problem now is to dispel the popular conception that power systems cause all the interference with radio reception. Discussion of the subject brought about agreement that only 20 per cent of all such complaints were traceable to sources within the control of the power company.

The hydraulic power committee, of which R. L. Hearn, Washington Water Power Company, is chairman, reported that the subject of fish ladders had been delegated to it by the national committee but that no work on this subject will be undertaken until after the special committee now working on it has finished its experiments. J. B. Fisken, Washington Water Power Company, told of the experiments of his company in forecasting the water supply of Cœur d'Alene Lake by measuring the snowfall on the watersheds of the three main rivers feeding this lake.

In reporting on power-plant efficiency as related to plant operation, L. J. Pospisil, Washington Water Power Company, described the Gibson method of obtaining the rate of flow of water in a penstock, involving a photographic indication of the result of the changes in pressure in the penstock when the gates are closed against the flow. D. W. Proebstel, Portland Electric Power Company, explained his adaptation of the Pitot tube method to accomplish the same purpose.

As part of the report of the apparatus committee, headed by R. R. Robley, Portland Electric Power Company, a paper on "Electricity in the Woods" was presented by R. E. Gray, Snoqualmie Falls Lumber Company, giving data on electric logging operations. E. F. Whitney, General Electric Company, Portland, made the significant statement that there were two thousand logging engines operating in the Northwest, of which only about twenty-five were driven electrically. Results of tests covering the range of ratio and phase angle of the comparatively new Niagara-type, air-insulated current transformers were given in a paper by J. Hellenthal, Puget Sound Power & Light Company.

The overhead-systems committee, Z. E. Merrill, Mountain States Power Company, reported, is making a comparison between treated and untreated poles. Other subjects touched on by this committee were the tests of pin-type insulators being conducted at the Oregon Agricultural College, live-line insulator testing and butt-treating of cedar poles.

J. B. Fisken, chairman of the accident prevention committee, called attention to one of the commonest causes of accidents in this geographic division, the moving of hay derricks under transmission lines, and recommended remedial state legislation. Among the recommendations of the committee was one advising against the use of pulmotors and favoring the Schaefer prone-pressure method of resuscitation.

R. E. Thatcher, Puget Sound Power & Light Company, chairman of the meter committee, explained the policy of his company in using polyphase meters for measuring three-wire loads, because of the inherent inaccuracy of three-wire meters under conditions of unbalanced voltage and overload.

O. L. Le Fever, chairman of the prime movers committee, raised the question of whether companies in the Northwest were overlooking the advantage of developing power by the use of low-grade coal at the mine mouth.

Considerable discussion was evoked by a paper on the possibility of an inexpensive underground distribution system presented by R. S. Carroll, chairman of the underground systems committee. The paper described an underground system designed to serve a typical high-class residence district in which a large range load was contemplated, and it was shown that the system could be installed at a cost of 10 per cent over the cost of an overhead system.

Pacific Coast Technical Section Closes Active Year

The last conclave of the Technical Section of the Pacific Coast Electrical Association, recently held at Fresno, Cal., was attended by nearly a hundred men. The work of the various committees for the year was summed up and several papers were presented.

Details of design and results of tests on four types of steel poles were reported on by the overhead systems bureau. A sub-committee devoted the entire time at its three meetings of the year to a revision of the California Railroad Commission's order covering overhead line construction. It is hoped that the commission will give favorable consideration to the committee's recommendations.

A discussion of means of increasing the rating of oil circuit breakers to meet present-day requirements brought out many interesting suggestions in the meeting of the apparatus bureau. The committee recommended that Pacific Coast practice in transmission and distribution substations be made the major topic of study by next year's committee.

A complete report on hydro-electric plant layout based on twelve plants of six California companies was prepared during the year by the hydraulic power bureau. Other topics discussed were the grounding of generators, painting

of penstocks, evaporation and percolation in storage reservoirs, and expansion joints in penstocks.

Discussion at the meeting of the prime movers bureau ranged around the equipment in the new Long Beach steam plant of the Southern California Edison Company and a report of the heat balance in that station.

During the year's work the underground systems bureau took up the study of concrete duct construction, manhole construction and high-voltage cable design, construction and operation. The use of the kenotron testing set and its application to the locating of faults on underground cables were explained. The fact was brought out that some companies on the Pacific Coast are having good results with voltmeter and exploring coil methods in locating faults on submarine and drawn-in cables.

At the meeting of the executive committee it was decided to ask the president of the Pacific Coast Electrical Association to appoint a vice-chairman each year in the interest of continuity of the work of the section. The practice of having each bureau, which will hereafter be called committee, suggest topics of study for the incoming committees was adopted at this meeting.

Briefer News

J. G. White Offices Removed.—The J. G. White Management Corporation of New York has moved its offices from 43 Exchange Place to the Federal Reserve Bank Building, 33 Liberty Street.

Freeman Gives Fund for Hydraulic Research.—John R. Freeman, consulting engineer, Providence, has made a gift of securities valued at $25,000 to the Boston Society of Civil Engineers for the establishment of a fund the income of which is to be used for encouraging research by the younger engineers of the society through the establishment of prizes for papers on hydraulics and allied subjects.

One Hundred Millions Wanted to Harness Bay of Fundy. — Premier Veniot of the Province of New Brunswick, Canada, had a conference recently with Dexter P. Cooper, the American engineer who is trying to promote the tidal-power project on the Bay of Fundy. The cost of this scheme is put at a hundred million dollars and the amount of energy that could be developed at 600,000 hp. The site selected is Passamaquoddy Bay, at the mouth of the St. Croix River. The project is international in character.

New Transmission Lines of Alabama Power Company.—The Alabama Power Company has announced that it is about to begin construction of a high-tension transmission line from Birmingham to Haleyville, Ala., where it has purchased the steam-power plant. Construction has been started on the company's transmission line from the Warrior steam plant to Leeds, which is to be built at a cost of $350,000 and will connect with the substation being built by the Birmingham Electric Company.

Drought Causes Power Shortage in Brazil. — Severe drought in the São Paulo section of Brazil extending over many weeks has caused a great falling off in the supply of hydro-electric power and, in spite of the requisition of all available steam auxiliaries, has interfered with the industral situation. As a result there has been a marked decline in the earnings of traction and power companies.

United Light & Power's New Davenport Office Building.—The United Light & Power Company, whose operating headquarters are in Davenport, Iowa, is erecting an office building at Second and Perry Streets, to cost $250,000. The new building will be the operating and engineering headquarters of the United Light properties, including the Continental and other plants recently acquired, as well as of the local companies. It will be 90 ft. x 116 ft. and five stories high.

Opponent of Oklahoma Indeterminate Franchise Law Seeks Referendum.—Although the County Attorney of Oklahoma County has declared entirely baseless charges of bribery made by State Senator Jed Johnson in connection with the passage of the indeterminate utility franchise bill by the Oklahoma Legislature, Senator Johnson is endeavoring to stir up public opinion against the bill in order to get it before a referendum of the voters. Other political opponents of the measure, however, are against a referendum and urge that a fair trial be given to the new law.

Buffalo Holds Successful Electric Show.—Good attendance has marked the Buffalo Electric Show, at the Elmwood Music Hall, which opened on April 23 and will run until the night of May 2, under the auspices of the Electric League of the Niagara Frontier. Besides the usual exhibits from manufacturers of great and small equipment, many special features have been carried out, among them a display of store-window lighting which follows out the course of daylight, increasing from the glow of dawn to the intensity of noonday and gradually receding to indicate twilight.

Steinmetz Memorial Lectures.—As a memorial to Dr. Charles P. Steinmetz, chief consulting engineer of the General Electric Company, the Schenectady Section of the American Institute of Electrical Engineers has initiated a series of annual lectures, to be known as the Steinmetz lectures. They will include talks on various aspects of science and engineering presented by recognized leaders in the fields covered. The first will be given by Dr. M. I. Pupin of Columbia University on May 8. His subject will be "Law, Description and Hypothesis in the Electrical Science."

Opposition to Proposed New Hydro-Electric Plant on Kentucky River.—A great deal of opposition was voiced at Beattyville, Ky., at a recent hearing conducted by a representative of the Federal Power Commission to the application of the Kentucky Hydro-Electric Company for a preliminary permit to build another dam on the South Fork of the Kentucky River, near Booneville. It was asserted that only a rim of Owsley County would be left if the lake was formed and that the project would be an extremely costly one.

Virginia Railway & Power Company's New High-Tension Line Begun.—The 65-mile transmission line between Suffolk, Va., and Roanoke Rapids, N. C., which was foreshadowed in the annual report of the Virginia Railway & Power Company two weeks ago, has already been begun by the contractors, the Hoosier Engineering Company of Indianapolis. It will be of steel-tower construction and will be operated at 132,000 volts.

Engineering Council to Consider Waste Elimination. — The administrative board of the American Engineering Council will meet in Philadelphia on May 8 and 9, when engineers representing more than thirty local and national societies in all parts of the country will attend. The council will co-operate closely with the Department of Commerce and other agencies in carrying out the purpose of the recent "round-table conference" on waste elimination held under the direction of the National Civic Federation in New York.

Winnipeg Competitive Situation Adjusted. — An agreement between the Winnipeg (Manitoba) Electric Company and the municipal hydro-electric system of that city has been worked out along lines indicated in "Briefer News" for March 14 (page 583). By this plan the central-station company relinquishes all territory in the city proper to the municipal plant, while the hydro system in turn withdraws from furnishing service to the suburbs. Thus a tensely competitive situation of many years' standing is abolished, with a saving to both company and city of the heavy outlay that has been involved in the solicitation of business.

Rates Reduced for Power from Don Pedro Irrigation Plant.—The rates on power from the Don Pedro plant of the Modesto Irrigation District have been voluntarily reduced, the reduction averaging from 10 to 15 per cent. There is a surplus of power and the new rates are designed to increase consumption. A committee report stated that "after deducting interest on all bonds voted for electrical purposes, providing a sinking fund for depreciation, and charging all money expended for maintenance and operation, including fuel oil and water purchased, this department has accumulated a net profit of $65,235," or 8.26 per cent.

Power for Staten Island Railways to Be Ready Very Soon.—The Associated Gas & Electric Company announces that on May 15 it expects to begin supplying power from its Staten Island (N. Y.) plant to the electrified lines of the Staten Island Rapid Transit Company in Richmond Borough, New York City. The increased generating installation at the Staten Island plant is expected to be completed by that time. As the power demands of the railroad will not equal capacity of the plant during the first year, a contract for sale

of power to the Public Service Corporation of New Jersey has been made to help take care of the latter company's requirements during the construction of the Kearny power plant.

Twin State Company in New Offices.—The Twin State Gas & Electric Company has moved its executive offices from 160 State Street to 131 State Street, Boston, where about twice the former floor space is available. The new address is also the headquarters of the Vermont Hydro-Electric Corporation and the Rutland (Vt.) Railway, Light & Power Company, control of which was recently acquired by the Insull interests by purchase from W. S. Barstow & Company, New York. The Twin State company has for some time operated various central-station properties in New Hampshire and Vermont from the Boston headquarters.

Free Power for Six Months Offered by Louisiana Power Company.—As an inducement to industries to locate in the neighborhood of Monroe, La., where the Louisiana Power & Light Company is building a 100,000-hp. gas-fired generating plant, the company is offering free power for six months and the lowest possible figure thereafter to the first textile or similar industry established in the region. Negotiations are under way with Monroe and other towns to take over their plants. The Louisiana Power & Light Company is a subsidiary of the Arkansas Light & Power Company, and eventually its lines will form part of an interconnected system embracing also the lines of the Arkansas company's Mississippi subsidiary, the Mississippi Power & Light Company, which serves Vicksburg, Jackson, Greenville, Columbus, Tupelo and other places.

Insull Interests Seek to Buy Indiana Electric Utilities Company and Others.—The Calumet Gas & Electric Company is about to file a petition with the Indiana Public Service Commission asking permission to buy the Indiana Electric Utilities Company, operating in northeastern Indiana. The Calumet company also seeks permission to buy the C. F. Cain Power & Light Company, operating two hydro-electric plants in Lagrange County; the Hawk Brothers Company, which operates a hydro-electric plant at Mongo, Ind., and the Bass Lake Light & Power Company near Knox, Ind. According to the petition, the proposed purchase price is $576,530, and in addition the purchaser is to assume the payment of $180,400 of funded debt of the Indiana Electric Utilities Company. The Calumet Gas & Electric Company is backed by the Insull interests. Samuel Insull is president and Charles W. Chase of Gary, Ind., is vice-president.

New York Commission Divides Three Towns Among Four Companies.—Consent has been granted by the Public Service Commission of New York to four power companies to exercise electric franchise rights in the three towns of Malta, Stillwater and Saratoga, Saratoga County. The companies are the Adirondack Power & Light Corporation, the Dwaas Electric Company of Hudson Falls, the Halfmoon Light, Heat & Power Company of Mechanicsville and the Consolidated Electric Company of Greenwich. In each town the town boards had granted franchises to two companies, and the orders of the commission specify the territory which each may serve so that there will be no duplication of service. The Adirondack corporation will serve a part of each of the three towns, dividing the town of Malta with the Dwaas company, the town of Stillwater with the Halfmoon company and the town of Saratoga with the Consolidated company.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, January 3, page 76.]

Southwestern Public Service Association—Rice Hotel, Houston, Tex., May 5-8. E. N. Willis, 403 Slaughter Bldg., Dallas.

American Institute of Electrical Engineers—Swampscott, Mass. (regional), May 7-9; Saratoga, N. Y., June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

Missouri Association of Public Utilities—Joplin, Mo., May 7-9. F. D. Beardslee, 315 North 12th St., St. Louis.

Pacific Division, Electrical Supply Jobbers' Association—Arlington Hotel, Santa Barbara, Cal., May 7-9. Albert H. Elliot, 502 Flatiron Bldg., San Francisco.

American Society of Mechanical Engineers—Milwaukee, May 18-21. C. E. Davies, 29 West 39th St., New York.

Southeastern Water and Light Association—Hotel Patten, Chattanooga, Tenn., May 19-21. W. F. Steiglitz, Columbia, S. C.

Electrical Manufacturers' Club—Hot Springs, Va., May 19-22. S. B. Belden, Jeffrey Manufacturing Co., Columbus, Ohio.

Middle West Division, N. E. L. A.—Hotel Fontenelle, Omaha, Neb., May 20-22. (Conjointly with Nebraska Section.) H. M. Davis, Fraternity Building, Lincoln, Neb.

Georgia Electrical Association—Atlanta, May 21-22. W. W. Barr, Georgia Railway & Power Co., Atlanta.

Electric Power Club—Hot Springs, Va., May 25-28. S. N. Clarkson, B. F. Keith Bldg., Cleveland, Ohio.

Electrical Supply Jobbers' Association—Hot Springs, Va., June 2-5. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Association of Engineers—Orlando, Fla., June 2-5. C. E. Drayer, 63 East Adams Street, Chicago.

Iowa Section, N. E. L. A.—Waterloo, Iowa, June 3-4. H. E. Weeks, 623 Union-Davenport Bldg., Davenport.

National Electrical Credit Association—Atlantic City, June 6-7; Philadelphia, June 8-9. F. P. Vose, Marquette Bldg., Chicago, Ill.

Associated Manufacturers of Electrical Supplies — The Homestead, Hot Springs, Va., June 8-12. F. Nicholas, 30 East 42d St., New York.

Northwest Electric Light and Power Association (Geographic Division N. E. L. A.)—Gasco Bldg., Portland, Ore., June 12. W. A. White, Puget Sound Power & Light Co., Portland.

Pacific Coast Electrical Association (Geographic Division N. E. L. A.)—San Francisco, June 15. S. H. Taylor, 529 Rialto Bldg., San Francisco.

National Electric Light Association—San Francisco, June 15-19. M. H. Aylesworth, 29 West 39th St., New York.

Society for the Promotion of Engineering Education — Union College, Schenectady, N. Y., June 17-20. F. L. Bishop, University of Pittsburgh, Pittsburgh.

National Council Lighting Fixture Manufacturers and National Association of Lighting Equipment Dealers—The Ambassador, Atlantic City, June 17-19. Herman Plaut, 432 E. 23d St., New York.

Good Progress on Miami Fort Station.—All substructure work has been completed and most of the structural steel is in place for the initial 80,000-kw. Miami Fort power station of the Columbia Power Company being built on the Ohio River, about 20 miles west of Cincinnati, the design of which was described in the ELECTRICAL WORLD for December 20, 1924. All construction work on the station is progressing rapidly and is up to the schedule, according to which the first unit will be placed in operation by October 1 and the second by December 1. Two steel-tower transmission lines, each carrying two circuits of 400,000-circ mil copper, are already under construction. The estimated cost of the power station proper is $12,000,000. The estimated cost of the transmission line is $660,000.

Program of Middle West Division, N. E. L. A.—The third annual convention of the Middle West Geographical Division, N. E. L. A., will be held at the Fontenelle Hotel, Omaha, on May 20, 21 and 22. The program will feature rural electrification, with Prof. E. A. Stewart of Red Wing, Minn., making the principal address on that topic and representatives from agricultural colleges in each state in the division participating. Chairman Putnam of the National Commercial Section will participate in the program. Miss Sophia Malicki will address the session devoted to women's public information bureaus, Frank L. Blanchard will speak on advertising and Earle M. Hodges on general publicity. Regulation, customer ownership, domestic refrigeration and employee relations will be discussed by authorities on these subjects. Dr. Charles A. Eaton will be the speaker at the banquet and dance carnival on the evening of Thursday, May 21.

Lewiston, Idaho, Accepts Clearwater River Proposal.—The proposal of the Inland Power & Light Company and the Clearwater Timber Company to establish a power plant, lumber mills and a log storage pond on the Clearwater River at Lewiston, Idaho, at an estimated investment of more than $5,000,000, has been accepted by the Council of that city. This enterprise was referred to in the ELECTRICAL WORLD for April 18, page 839. The city has dropped its plans for a bond election to authorize a municipally owned power plant and has agreed to aid in procuring sites at reasonable prices. The companies will begin operations at once and have agreed to have the plants in operation by the spring or early summer of 1927. The timber and power companies have agreements with the Union Pacific and Northern Pacific railroads for extensions into the Clearwater timber belt, and it is estimated by officials of the companies that the total immediate investment incident to the power development, milling operations and railroad extensions will aggregate $12,000,000. The Inland Power & Light Company is a subsidiary of the American Power & Light Company.

Men of the Industry

Belden Heads New England N. E. L. A. Division

Frank A. Belden, who was elected president of the New England Division of the N. E. L. A. at the annual business meeting, has been in the Northeastern central-station field since 1913. He was born in Aurora, Ill., in 1880, and his early work in the public utility industry included service with the Aurora Street Railway Company, the Georgia Railway & Power Company and the Chicago Railway Company and also field work with the Ross Construction Company of Chicago. Mr. Belden went to New England about 1910 as superintendent of the Dover, Somersworth & Rochester (N. H.) Street Railway and two

F. A. BELDEN

years later was made assistant general manager of the Massachusetts Northeastern Street Railway with headquarters at Haverhill. In 1913 he was appointed superintendent of the Rockingham County Light & Power Company with offices at Portsmouth, N. H., becoming vice-president and general manager in 1920. Early this year he resigned to become assistant to the general superintendent of the Edison Electric Illuminating Company of Boston.

Daniel Safford has been elected assistant secretary and assistant treasurer of the Virginia Railway & Power Company, Richmond, to succeed George H. Taylor, recently advanced to a vice-presidency in the company.

C. H. Meeks, formerly chief engineer of the Port Arthur power station of the Eastern Texas Electric Company, has been transferred to the Lake Charles (La.) Electric Company, Inc., as chief engineer. Both these properties are under Stone & Webster management.

B. S. Gordon, formerly district manager of the Alabama Power Company at Roanoke, has been appointed superintendent of local operations at the company's Anniston office to succeed L. W. Crane, recently transferred to Birmingham.

Rufus E. Lee, who resigned March 1 as president of the Continental Gas & Electric Corporation, has organized, with Foy W. Porter and Roderick D. Clark, Rufus E. Lee & Company to do a general investment busines with offices in Omaha. Mr. Porter was formerly with Burns, Brinker & Company, and Mr. Clark was formerly with George & Company. The details of Mr. Lee's career in the public utility field were published in the February 21 issue of the ELECTRICAL WORLD, when his resignation as president of the Continental company was announced.

Thomas N. McCarter, president of the Public Service Corporation of New Jersey, has just returned to this country following a short trip abroad.

J. H. Pardee, president of the J. G. White Management Corporation, has just returned to New York after an extended business trip through the Far East. During his stay in the Orient Mr. Pardee visited the Philippines, China and Japan.

D. S. Jones of Center, Col., a former member of the Colorado Legislature and politically active for a number of years, was appointed last week by Governor Clarence J. Morley as a member of the Public Utilities Commission to succeed Grant Halderman, whose term expired last January.

Chester Grey has been appointed district manager of the Consumers Power Company at Lansing, Mich. Through the consolidation of the electrical business of the Consumers Power Company in Lansing and vicinity with the gas service of the Lansing Fuel & Light Company, which has recently been acquired by the power company, this new district has been added to the Consumers Power Company territory. Mr. Grey for several years has been manager of the Lansing Fuel & Light Company.

William N. Brownlie has joined Stone & Webster, Inc., as engineer in the electrical division at their Boston office. During the world war Mr. Brownlie served with the Royal Engineers of the British forces. For three years following the war he was with the British Thomson-Houston Company, Ltd., and the past two years he has been in South Africa on engineering and construction projects, having most recently been engaged in technical and sales duties with R. L. Weir & Company, representing Siemens, Ltd.

Arthur D. Blanchard, formerly a member of the engineering department of Charles Cory & Son, Inc., has been transferred to the industrial sales staff of that organization. Prior to his association with Charles Cory & Son, Inc., Mr. Blanchard was engaged with the business of the Crocker-Wheeler Company as plant engineer in charge of construction, operation, personnel organization, maintenance, design, drawing estimates and reports. Mr. Blanchard's wealth of experience will be applied to assist central-station and railroad executives in the accomplishment of efficient operating and protection standards.

M. R. Scharff Receives Promotion

Maurice R. Scharff, valuation engineer of the Philadelphia Company for the past four years, has been appointed chief engineer of that organization and affiliated corporations. In this position Mr. Scharff has charge of the engineering work of the principal public utilities of Pittsburgh, including the Duquesne Light Company, Equitable Gas Company and Pittsburgh Railways Company. Mr. Scharff was born in Natchez, Miss., and was educated at Stanton College, Natchez, and Phillips Exeter Academy. He was graduated from the Massachusetts Institute of Technology in 1911 with the degree of master of science. For several months after his graduation Mr. Scharff did special investigation of an engineering nature in Boston and in Trenton, N. J., and in October of the same year he became associated with the Alabama Coal Operators' Association at Birmingham. He left the association in July, 1912, to be-

M. R. SCHARFF

come associated with Morris Knowles, engineer of Pittsburgh, as assistant engineer. In August, 1916, he was assistant chief engineer and vice-president of Morris Knowles, Incorporated, which position he retained until May, 1921, when he was made valuation engineer of the Philadelphia Company and affiliated corporations. During his association with Mr. Knowles Mr. Scharff devoted considerable time to the valuation, design and construction of public works and later included among his studies public utilities. On November 1, 1924, Mr. Scharff was promoted to be production and valuation engineer, from which position he has been appointed to the post of chief engineer.

P. H. Wheeler, who has been local manager of the Consumers Power Company at Mason, Mich., has been appointed district superintendent of electrical distribution at Lansing.

D. J. Fleming has joined the engineering staff of Ophuls & Hill, Inc., engineers, New York City. Mr. Fleming is to devote his activities to industrial engineering problems and brings to his new connection many years of unusually wide and varied experience. He received his early training in the testing department of the General Electric Company at Schenectady, N. Y., and the engineering department at the Lynn works. Subsequently he held important positions with the Allis-Chalmers

Manufacturing Company and the Westinghouse Electric & Manufacturing Company. He was for about eight years actively engaged in the construction, operation and management of public utility gas and electric properties and just recently was engaged by Sanderson & Porter on the valuation of properties of one of the largest public utilities in the East.

Francis Hodgkinson, chief engineer of the South Philadelphia works of the Westinghouse Electric & Manufacturing Company, to whom was recently awarded the Elliott Cresson gold medal by the Franklin Institute in recognition of scientific accomplishments, started on an extended trip to Japan April 30. He is leaving by way of San Francisco, whence he will sail May 12 for Yokohama on the S.S. *Korea Maru.* Mr. Hodgkinson will be absent approximately three months on this special mission to the Island Empire, in the course of which he will have extensive contact with leading Japanese engineers.

L. A. Leissler, who has been connected with the Chicago plant of the Reynolds Electric Company for a number of years, has temporarily been placed in charge of the company's New York office, following the death of C. W. Ellis, formerly New York representative.

Stanley Taber of the People's Light Company, Davenport, Iowa, has been made manager of the Nebraska Gas & Electric Company with headquarters at Lincoln, Neb. The appointment was announced by C. A. Nash, sales manager of the United Light & Power Company, owner of the Nebraska Gas & Electric Company.

Harold A. Relyea of Oneonta, N. Y., formerly engaged in the construction of high-tension steel-tower transmission line work for Stevens & Wood, Inc., in the vicinity of Youngstown, Ohio, is now working as distribution engineer for some of the recently acquired Catskill Mountain properties of the J. G. White Management Corporation of New York.

W. E. Herring, for the past four years assistant manager of the Philadelphia Suburban Gas & Electric Company, became division manager of the company on May 1. Mr. Herring has had broad experience in the utility field. For a number of years preceding his connection with the above company he was associated with the Puget Sound Power & Light Company, a Stone & Webster property, and later was in the Boston office of Stone & Webster.

Henry F. Dicke, for the past eight years general manager of the Utah Light & Traction Company, Salt Lake City, has been made vice-president of the East Penn Electric Company, Pottsville, Pa., vice-president of the Williamsport Passenger Railway, Williamsport, Pa., and assistant to the president of the Lehigh Valley Transit Company, operating between Allentown and South Bethlehem, Pa. His headquarters are in Allentown.

Arthur L. Mudge, who has been associated with Kerry & Chace, Ltd., consulting engineers of Toronto, for more than seventeen years as chief electrical engineer, has been appointed senior electrical engineer on the staff of the Canadian section of the joint board of engineers for the St. Lawrence deep waterways project. After graduation from McGill University, Montreal, in 1894, Mr. Mudge spent some years with firms manufacturing turbines and electrical machinery in Canada and the United States. In 1907 he became associated with Kerry & Chace and since that time has been responsible for the design of a number of hydro-electric power installations in Canada.

James C. Clark, until recently professor in charge of electrical engineering research at Iowa State College, has resigned that position to become sales engineer for the Pacific Electric Manufacturing Company, San Francisco, designer and builder of oil circuit breakers and other high-voltage line equipment. Before going to Iowa a year ago Mr. Clark was associate professor of electrical engineering at Stanford University. During his twelve years at Stanford he was identified with the high-voltage research carried on at that institution.

L. W. Griffith, superintendent of the Connellsville power station of the West Penn Power Company, has been transferred to the power development department with headquarters in Pittsburgh.

C. Dwight Briggs has been appointed manager of the Norwalk district of the Connecticut Light & Power Company to succeed Eben F. Putnam recently transferred to the New Britain district superintendency. Mr. Briggs was formerly connected with the Western Union Telegraph Company and more recently with the New York, New Haven & Hartford Railroad as communication engineer. A short time ago he affiiliated himself with the Connecticut Light & Power Company.

Edward A. West, general superintendent of the Denver Tramway Company, Denver, has been appointed general manager of the Utah Light & Traction Company, Salt Lake City, to succeed Henry F. Dicke, who has assumed new duties in Allentown, Pa. Mr. West has been with the Denver Tramway for the past nine years and previously was on the executive staff of the Portland (Ore.) Railway, Light & Power Company, now the Portland Electric Power Company.

Obituary

A. O. Backert

A. O. Backert, president of the Penton Publishing Company, Cleveland, and for many years an outstanding figure in the publishing world, died suddenly April 24 of heart disease. He had just returned to Cleveland from a month's vacation following an illness of several weeks. Mr. Backert was born in Cleveland in 1876 and attended Western Reserve University for several years. Entering the field of industrial publishing in 1900, he had during that period of time been affiliated with the *Iron Trade Review, The Foundry* and *Iron Age* and had served as vice-president and general manager of the Penton Publishing Company before becoming president.

He served on the executive committee of the Associated Business Papers, Inc., from 1919 to 1924 and was honored with the presidency of this association for the term 1922-1923. He was the author of the standard book on foundry practice and was prominent in the associations connected with the foundry industry. As a publisher Mr. Backert built a monument to his memory that will long endure and the publishing world has sustained a great loss in his death.

Abraham L. English, local manager of the Citizens' Gas & Electric Company at Council Bluffs, Iowa, died April 15 as the result of apoplexy. Mr. English, who was prominent in Iowa public utility circles, advanced step by step from the position of a lamp trimmer to the executive position with the Council Bluffs utility.

Charles Frederic Wittmann, internationally known engineer and a pioneer in cable development, died recently in Montreux, Switzerland, where he had spent the last seventeen years of his life. Mr. Wittmann was born in Mayence in 1846 and after completing his grammar-school education he left his native town for Paris. Subsequently obtaining employment in a shop where precision instruments were manufactured, he worked on various electrical devices and as early as 1867 he had devised a self-recording Morse apparatus. This achievement was the cause of his appointment by Siemens Brothers in London, where before long he succeeded in making a name for himself. Later Rathenau of the Allgemeine Elektricitäts-Gesellschaft intrusted him with the formation of the company's cable department, of which he became head, reaching in this office the height of his fame.

Harry H. Lloyd, purchasing agent for the Terre Haute, Indianapolis & Eastern Traction Company and the Indianapolis Street Railway, died April 21. Mr. Lloyd had been associated with these Indianapolis utilities since 1905. He was a native of Manchester, England, and was forty-two years of age.

C. W. Ellis, New York representative of the Reynolds Electric Company, Chicago, died April 8 after a three weeks' illness. Mr. Ellis had been in charge of the Eastern territory for more than six years and had a wide acquaintance in New York as well as in Boston, Philadelphia, Washington, Baltimore and other Atlantic Coast cities.

Sir Augustus Meredith Nanton, formerly president of the Winnipeg Electric Company and a leading Canadian industrialist, died April 24 at his home in Toronto, following an illness of several weeks. Sir Augustus resigned the presidency of the Winnipeg utility, with which he had been connected since 1898, last December to become president of the Dominion Bank, retaining, however, his membership on the board of directors. In addition to his connection with the Winnipeg company and the Dominion Bank he was a director in numerous industrial enterprises.

Recent Court Decisions

Death of Lineman Cutting Wire While Off Duty Did Not Occur Within Scope of Employment.—In considering an appeal from a judgment of the State Industrial Board (in Mills vs. Fulton County Gas & Electric Company) the Supreme Court of New York, Appellate Division, held that the death of a lineman while cutting an electric wire when he was off duty did not occur within the scope of his employment and reversed the judgment of the Industrial Board. The lineman had found one of the company's high-voltage wires in contact with a tree, children and others standing by, and had attempted to get in touch with the company's general line foreman, to whom the rules of the company obliged him to look for orders, but the foreman was not at home. The foreman's daughter advised the lineman to report the matter to a local foreman who lived near by. He was, of course, under no obligation to follow this advice. However, although the case presented no pressing emergency, he attempted instead to cut the wire and was killed. The court held that the man's moral duty would have been fulfilled had he merely kept the bystanders away until the arrival of some one with authority and that the company was not liable for his poor judgment. (208 N. Y. S. 641).*

Purchasing Power of the Dollar, Depreciation and Rate of Return.—The United States District Court for Maryland upset rates fixed by the Public Service Commission of Maryland for the Chesapeake & Potomac Telephone Company of Baltimore, finding them confiscatory as not affording a fair return on the value of the company's property. In the course of a long opinion the court dealt with the purchasing power of the dollar and held that it was not likely to increase for years to come and that "the study we have made of the testimony, the exhibits and arguments has convinced us that the present value of the company's property, if it were new, differs little, if at all, from the present worth in the monetary units of today of the dollars invested in it, whether in money owned or owed, plus, in the same character of dollars, the allowance made years ago by the commission for the worth of its established business." This figure, as fixed by the court, was three times the value fixed by the commission. From it, however, the court deducted the entire depreciation reserve of the company, although the company maintained that about one-third of it did not represent deterioration and should be treated as investment. The court stressed the importance of a depreciation reserve having a large margin to meet emergency. Against the company's contention that there should be allowed to it a return of 8 per cent the court held that in view of the relations between the Maryland and national companies 6 per cent was a fair return. In conclusion it summarized its findings as follows: "We are not a rate-making body. All that we decide is that the commission may not deny the company permission to charge rates which will produce at the minimum 6 per cent on the fair value of its property at the time used or useful in telephone service, and that on December 31, 1923, that property was at a value of $29,507,949. Today it is, of course, that value plus whatever net additions to it have since been made, diminished, however, by whatever net increase, if any, there has been in the unexpended balance standing to the credit of depreciation reserve." (3 (2d) Fed. 938.)

Rates Must Insure Investors a Reasonable Return.—The Missouri Supreme Court has upheld the validity of electric lighting and steam-heating rates granted by the Missouri Public Service Commission in December, 1918, to the Union Electric Light & Power Company of St. Louis. The case had been pending in the Supreme Court for four and a half years. The issues in eighteen cases had been joined, and all are covered by the decision. Ten St. Louis corporations had intervened in the litigation, attacking the validity of the rate increase. They were the owners of private lighting and heating plants that had been leased to the Union Electric Light & Power Company under agreement by which they were to be furnished electricity and heat at the rates fixed in their contracts. These rates were increased by the Public Service Commission. The decision reverses the Cole County Circuit Court, which had set aside the rate order granting the increase for a test period of one year. Owing to the litigation the rates have been in effect since the original order of the commission, the difference between them and the rates superseded having been impounded. In its opinion the court reiterated previous rulings that the terms of a franchise or a contract between a consumer and a public utility are not binding on the Public Service Commission in rate making. The court swept aside the contentions of the consumers that the Public Service Commission did not have jurisdiction over steam-heating rates and that the commission had no authority to set aside the rates for service fixed in the contracts with the power company. It held that the only question at issue was the propriety of the rates fixed by the commission. On that point it declared that the original contracts between the owners of the private plants and the Union company had no validity in so far as they affected rates. "The Public Service Commission," the court said, "in fixing rates, cannot be clogged or obstructed by contract rates." The court further asserted that the Public Service Commission law was intended to require the public to pay rates which would not only keep public utility plants in proper repair for effective public service but insure the investors a reasonable return upon funds invested in the utilities.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Distinction Between Valuation for Taxation and Valuation for Fixing Rates.—The owner of the Goshen Electric Company asked the Utah Public Utilities Commission to determine rates on a valuation of $8,000 and met with protests on the ground that the system was assessed at only $1,650. This led the commission, in fixing the valuation at $7,000, to distinguish between valuation for rate making and valuation for the purpose of taxation. "Rules governing tax valuations," said the decision, "depend upon tax laws. In valuing utility property for tax purposes, earnings are generally the controlling factor, and earnings depend largely upon rates. It is generally held to be to the interest of consumers as ratepayers that taxes levied upon utility property be kept on as low a level as possible, for taxes are directly chargeable to operating expenses, forming part of the rate paid by consumers, and a higher assessed valuation would simply add an additional burden upon ratepayers."

Failure to Collect Established Rates from All Consumers Constitutes Discrimination.—The Westford Light, Heat & Power Company alleged before the Wisconsin Railroad Commission that it had been unable to collect the rates established for its rural consumers by the commission and requested that its rates be redistributed in order better to satisfy the rural customers and that the rates charged by the Wisconsin Power & Light Company for wholesale power be reduced. The commission pointed out that the Westford company's load factor was less than 10 per cent, that its load was small, that its cost of distribution was high in rural territories, and that it was discrimination against town customers not to collect the full rate from rural customers. The commission agreed to readjust the rates slightly by providing for a smaller number of units in the first steps and lower unit costs for power in the last steps, but refused to lower the wholesale rates and insisted that all rates as authorized by it be collected fully.

Commission Jurisdiction Not Lost by Long Delay in Resuming Hearings.—The city of Sparta in March, 1921, began proceedings before the Wisconsin Railroad Commission to have a valuation of the Wisconsin-Minnesota Light & Power Company's property in Sparta made prior to the acquisition by the city of the power company's plant. The matter rested until April, 1924, when the city requested that the hearings be resumed. The company contended that the delay removed the case from the commission's jurisdiction, but the commission decided that its jurisdiction in a proceeding once commenced was not lost by reason of delay, regardless of the length of time that might intervene between hearings.

Manufacturing and Markets

Trade Association Activities

Their Economic and Legal Status Fully Discussed in Report of National Industrial Conference Board—Associations Have Distinct Place Within the Law

IN PURSUANCE of its purpose of scientific inquiry into the major economic problems affecting industrial conduct, the National Industrial Conference Board, 247 Park Avenue, New York, undertook a comprehensive survey of the development and present position of public policy in the control of private business organization and practices as embodied in the Sherman act and its supplementary legislation, generally referred to as the anti-trust laws, and in court and commission decisions and decrees based thereon.

The work of the board has been published in an elaborate report called "Trade Associations, Their Economic Activities and Legal Status." It is divided into five main parts. Part 1 deals with trade associations and the anti-trust laws, Part 2 with the evolution of public policy toward competition and co-operation, Part 3 with association activities and the regulation of competitive conditions, Part 4 with association activities essentially unrelated to competitive conditions, and Part 5 with the place of trade associations in the industrial structure.

Legal Position Defined

In discussing the legal position of trade associations the report says: "The legal principles governing trade associations are not essentially distinguishable from those applying to other forms of business organization. The problem is mainly one of concrete application to specific types of business arrangements of certain general principles, the development of which has been described. It follows that the lawfulness of a trade association depends in every instance upon the concrete purposes for which the association members are banded together and upon the means employed to advance these purposes. Purposes and intentions are judged in the courts primarily by actions, however, so that it is what an association does, and how it does it, which finally determines its legal status.

"Under the settled law, there is a certain range of association activities which are definitely forbidden because, in general, they tend to the suppression of competition. These activities center about the establishment of common production and price policies. There is another range of associated action for trade purposes in which lawfulness is dependent upon the manner, circumstances and results of the joint efforts.

"So long as activities within this field are confined to the provision of knowledge or information, emerging from the experience of the trade, and its utilization for the orderly development of commercial and industrial processes, they tend only to regulate competitive conditions and are not usually condemned. Finally, there is a certain range of association activities which give rise to few, if any, questions of legitimacy from the point of view of public policy. They are of a nature so unconnected with competitive relations or competitive business conduct that issues of anti-trust law are not involved.

Activities Under Ban of Law

"There have appeared at least four types of trade association activities which have come under the absolute ban of the law. These activities are concerned primarily with (1) unification in selling, (2) exclusion from the market, (3) curtailment of production, and (4) price manipulation. In all these cases the concert of action has been deemed to suppress competitive conditions." Each of these activities is discussed in detail. The report also covers the development of business ethics and the important function of trade associations in establishing such codes, and also the benefit of uniform contract forms and the possible danger in establishing such forms.

There are certain trade association activities that fall within a twilight zone, a region of associated action in which the law accords approval or enforces condemnation according to the intent and character of the restraint and the actual or probable consequences of the joint action in the special circumstances of each particular case. The following activities are cited by the board "as being representative, if not exhaustive, of this category of trade association function: (1) Operation of exchange, (2) collection and dissemination of trade statistics, (3) interchange of patent rights, (4) interchange of credit information, (5) negotiation of purchases, (6) standardization of products, (7) development of business standards.

"These activities, it is apparent, aim for the most part to utilize the trade association as a clearing house of knowledge and information and experience, for the common benefit of the industry as a whole, and to mitigate the flagrant maladjustments which have emerged from unrestrained competitive rivalry. Not all of these activities are universally or even commonly pursued among trade associations, but all of them have engaged the attention of the Department of Justice and the courts in recent years." In its report the board continues to examine in detail the character of these activities and to analyze their status under the anti-trust law.

In the collection and dissemination of trade statistics the board states: "It is not too much to say that the permanence of the association movement and in some measure the character of future industrial organization are bound up in the adequate solution of this problem. The ultimate and essential basis for the existence of trade associations is to be found in the opportunity they afford their members, who severally exercise independent control of industrial enterprises, to approach their undertakings and responsibilities, not as isolated tasks and obligations, but in their relationship to the whole network of activities by which society is provided with the particular product or service.

"The collection and dissemination of trade information in some measure and through some channel appears to be indispensable to the smooth ordering of manufacturing and marketing activity." The scope and limitations of the legal doctrine which is alleged to have cast serious doubt upon the legitimacy of the statistical service of trade associations is examined carefully in the report.

Standardization Work

The legal validity of co-operative standardization activities of trade associations, which have been undertaken at the instance of governmental departments and have been pushed forward by their co-operation, would seem to be unquestioned. "But," says the board, "any activity which regulates competition between the association members is capable of being abused."

The subject of commercial arbitration is one discussed in the report. The shortcomings of judicial determination of commercial disputes, the settlement of disputes among the associates and the settlement of disputes with outside parties are carefully outlined. The report shows that the arbitration process must be wholly of a voluntary character.

Place of Associations Defined

Finally the board points out the place of trade associations in the industrial structure. "Experience has demonstrated," the report says, "that the advantage to the public of protection against exploitation which is afforded by the competitive system may be destroyed by the very energy and resoluteness with which the self-interest of independent competitors is pursued. While the immediate injury to such trade competitors as become embroiled in this warfare is not at once reflected as a detriment to the consuming public, in the long run the conduct of industrial or commercial enterprises along these lines can lead only to business ruin.

"It appears that there is a distinct place for trade associations and their activities within the framework of the law, as there clearly is in the industrial structure. Broadly speaking, when trade associations undertake to perform functions which infringe upon the area

of legal prohibition, they are following a path which leads to no desirable economic end; while, on the other hand, if they enter upon economically defensible activities, there is little danger of their being subject to legal attack. While it is the policy of the law to maintain competition, it appears that this policy has been and may continue to be adhered to without prejudice to trade association work for essentially sound and constructive purposes."

Business Conditions

PURCHASING continues in good volume in most sections of the country. The attitude of buyers remains conservative, so that while total sales are good, they are made up chiefly of a large number of orders. Central-station companies are buying a good amount of distribution equipment, such as transformers, regulators, pole-line material, etc. The general opinion of several manufacturers is that sales during May will be better than in April, which was considered a good month. The steel industry continues to be in the market for large quantities of electrical equipment, orders for which are still pending.

Steel-mill companies have reduced their production and are now said to be operating at about 75 per cent of capacity. Consumers of steel are exhibiting plenty of caution and are buying only for immediate consumption. April orders in that industry are higher than those of March, and there does not appear to be any stocking of material by consumers, who are ordering more frequently in smaller quanties.

In New England sustained buying in small orders characterizes the movement of electrical supplies. Central-station companies in that territory are actively purchasing supplies for replacements and extensions. Sales are following a steady pace in the New York district, with no exceptionally large orders or indications of a boom, but with the volume good during April and the outlook for May better. In the Southeast campaign efforts of central-station companies are resulting in increased sales of electric ranges. A good movement of fans is noted in some sections of that territory, but business generally has been quiet. Various central-station companies are actively engaged in construction work in the Middle West, and industrial plants are operating at a normal rate. On the Pacific Coast sales are dull. Some large special orders have been placed in that territory, and several requests for quotations on assorted wiring material and street-lighting equipment have been received.

New England Manufacturers Report Credit Conditions Good

NEW ENGLAND electrical manufacturers are finding credit conditions good on the whole. Collections are about keeping pace with sales. Jobbers report average collections of about sixty days, the slower accounts belonging as usual to small contractor-dealers. An unusual number of small contractors and dealers have gone into bankruptcy in this district during the past seventy-five days, and one Boston jobbing house of long standing has been taken over by another and its doors closed.

The larger and better known jobbers report fair business and credit conditions, but there is much complaint against the practice of some houses of accepting poor contractor-dealer credit risks and engaging in vigorous price cutting. The radio market is badly demoralized by overproduction, price cutting and the "short-circuiting" of jobbers by manufacturers who are unloading overstocks directly upon retailers. The outlook for peaceful conditions in the building industry is now very encouraging, the various crafts having come to an agreement with the builders. Railroad, public utility and metal-working industrial plant credit conditions are favorable on the whole.

Sales of Electric Trucks Increase at a Steady Rate

ELECTRIC truck manufacturers report that they are extending their sales and service organizations at a sane and steady rate, encouraged by the results obtained in cities where electric trucks have been properly represented. The outstanding characteristic of the demand for electric trucks during recent years is the steady increase at an accelerated rate year after year. Sales of electric trucks in Manhattan, New York City, during 1924 increased 21 per cent over those of 1923. The present demand is good and bids fair to maintain the increasing yearly sales.

It is significant that a number of dealers handling well-known makes of gasoline trucks have begun to deal also in electric trucks, thereby acquiring a complete line of motor trucks for frequent-stop deliveries, short-haul trucking in congested areas and long-haul trucking and delivery. This movement indicates that gasoline truck representatives are recognizing in increasing numbers that electric trucks are essential to a complete scheme of truck transportation. It is encouraging to note that emphasis is being put more and more on the selling of transportation rather than trucks.

The outlook for the future is promising. No price revisions are at present contemplated, but the trend is downward owing to greater production. Manufacturers report that some economies already effected through more efficient manufacturing methods and increased production have resulted in an actual improvement of the product. The past few years, particularly 1924, showed a noticeable increase in the use of electric trucks, and in the promotion of sales in their respective territories, by central-station companies.

Delinquent Electrical Accounts Improve During March

DURING the months of February and March combined this year the number of delinquent accounts reported to the National Electrical Credit Association by member manufacturers and jobbers increased 3 per cent over the same months combined last year. The total amount of the delinquency increased 19 per cent and the average delinquency per account 26 per cent. There has been a remarkable drop in the average amount of delinquency for March as compared with February of this year, the comparative average amount of delinquency having fallen from 148 per cent in February to 102 per cent in March. The complete data are here presented in tabular form.

DELINQUENT ACCOUNTS IN MARCH

Branch and Month	Number of Accounts Reported	Total Amounts	Average Amount
Central Division:			
February, 1924	821	$89,621.45	$109.16
February, 1925	802	102,162.48	127.38
March, 1924	941	99,989.14	106.29
March, 1925	1035	123,857.54	119.67
New York:			
February, 1924	365	54,688.00	150.00
February, 1925	334	79,033.00	237.00
March, 1924	445	68,022.00	153.00
March, 1925	462	69,232.00	150.00
Philadelphia:			
February, 1924	258	31,823.03	123.35
February, 1925	242	28,614.50	118.24
March, 1924	233	26,163.85	112.29
March, 1925	220	29,438.68	133.81
New England:			
February, 1924	33	4,789.14	145.12
February, 1925	60	7,601.01	126.68
March, 1924	46	4,708.60	102.36
March, 1925	77	7,516.66	97.62
Pacific Coast:			
February, 1924	9	1,072.04	119.11
February, 1925	18	6,239.15	346.62
March, 1924	12	1,175.31	97.94
March, 1925	23	1,868.54	81.24

Prices of Non-Ferrous Metals Make Substantial Recoveries

PRICES of copper, lead and tin have advanced with rather sharp increases, especially in copper. The strength of these markets seems to be based mainly on improved business conditions abroad, although in lead the heavy volume of sales made to domestic consumers is in itself an explanation of the improved price of that metal. Nearly all copper producers report doing a large amount of export business during April. For all of them domestic sales have been slow at best. The rise in the price of copper last week can be attributed mainly to the heavy buying in Europe. In the domestic market copper producers have only sold moderate tonnages at prices reflecting the advance that took place in the London market. The announcement of production curtailment by some leading producers was very beneficial, and there are rumors afloat that other producers may follow suit. It is well to bear in mind, however, that some of the larger operating companies never did increase their output to capacity and cannot economically make any great cut in production at present.

The contract price for New York lead, set by the American Smelting & Refining Company, continues at 7¼ cents per pound. The reaction in the London lead market, with markedly higher

NEW YORK METAL MARKET PRICES

	April 22, 1925 Cents per Pound	April 29, 1925 Cents per Pound
Copper, electrolytic	13.30-13⅜	13.65
Lead, Am. S. & R. price	7⅛	7⅛
Antimony	11⅛	11⅛
Nickel, ingot	31	31
Zinc, spot	7.20	7.325
Tin, Straits	52⅛	56
Aluminum, 98 to 99 per cent	28	28

Base copper price April 29, 1925, 16 cents.

prices on Wednesday, Thursday and Friday of last week, led consumers in the United States to believe that the low point in the recent downward movement had been passed, and in the last week heavy tonnages have been bought. The demand has come from far and wide, all classes of consumers entering the market, principally for their May requirements. Few large individual sales have been made, most of the orders being for from one carload to 300 tons. Though sales have been large, no runaway market is anticipated, for plenty of lead is on hand to meet normal requirements, and no one has had to take less than he wanted, unless possibly he confined his inquiries to one producer. Prices in the New York market have been more stable than those in the West. Consumers are not inclined to speculate on the future lead market; they are merely playing a little safer than formerly in covering their nearby demands.

Sales of zinc have been by far the lightest in volume in months. The only feature of note has been an increasing interest in the market by Europe with a small amount of zinc sold abroad. Prices of tin are about 5 cents above the level of two weks ago. Buying has been fairly good during the week, the advance apparently having no particular effect in the volume of sales one way or the other.

Sales of Electric Ranges Increase in the Southeast

THROUGHOUT the Southeast business has been quiet. Fan sales, particularly in Floria, South Georgia and South Alabama, are increasing. The greatest demand is for both the ceiling and portable types, with few orders for exhaust fans as yet being received. Purchases of hollow ware are quiet, but a large central-station company in Georgia is preparing to enter the merchandising field on May 1, and its orders for preliminary stocks are swelling the volume of sales. Few orders for building materials are being placed. Purchases by contractors in the Atlanta district are slow, but they are quite satisfactory in the Birmingham district and Florida.

Campaign efforts of central-station companies are resulting in increased sales of electric ranges, and the prospects are for excellent summer sales. Automobile storage batteries are slow for this season of the year, but orders for mine-locomotive batteries in the Birmingham district and industrial truck batteries in New Orleans, Birmingham, Savannah and Charleston are above the average. Radio batteries, like all lines of radio equipment, are below the average for this season of the year, but batteries for oil switches and remote-control equipment are reported in brisk demand. Two 55-watt broadcasting equipment contracts are pending, with prospects of being closed within the next few weeks. Activities in industrial lines are fair to good, though textiles have failed to come up to earlier estimates. A cotton mill in South Carolina has just closed a contract for electrical equipment in connection with plant improvements totaling $200,000.

Maintenance and Construction Work Active in Middle West

BUSINESS continues good in the Middle West, although somewhat quiet. The volume has diminished a little, but maintenance purchases are increasing in volume. Various central-station companies are actively engaged in construction work and industrial plants are operating at a normal rate. An interesting order for sixty-five 400-amp., 750-volt circuit breakers was received by one manufacturer, and a utility company reports purchasing 150,000 lb. of solder. The demand for pole-line hardware, insulators, etc., has been quite brisk, while several sizable orders for motors and equipment were received.

Jobbers report a quiet week of sales. While the volume of business has fallen off somewhat, the feeling is optimistic and few complaints are heard. An extremely warm day for this time of the year, followed by continued warm weather, has started fan sales. The fan season last year was very short and rather unsatisfactory from the jobbers' viewpoint. Prices remain firm generally.

Small Orders in Good Volume Mark Selling in New England

SUSTAINED buying in small orders characterizes the movement of electrical supplies throughout New England. Supplies for replacements and extensions by central-station companies continue to be quite active. A fair demand for poles, line hardware, cable and wire is reported by jobbers. The sale of motors, on the other hand, is confined to single orders of small horsepower, though the volume in general shows an encouraging trend.

Domestic appliances are in good demand and in considerable excess over last year. One group, comprising fourteen central-station companies, reports the sale of several refrigerating units. Cleaners, portable lamps, welding units, electric heating furnaces and refrigerating units show an exceptionally strong upward sales trend, and there is a strong demand for electric irons and kitchen units. A five-year wholesale power contract has been signed by a company in Haverhill, Mass. In this same locality a number of electric glue pots have been installed in several factories. One company reports the installation of a shoe-drying machine in its factory. House wiring in suburban districts is active. In general both jobbers and central-station groups report fair business for the month of April.

Sales Good—May Outlook Better in New York District

SALES in the New York district are continuing in good volume. Business is following a steady pace with no exceptionally large orders or indications of a boom, but with the volume good during April and the outlook for May better. Central-station companies are buying in steady volume and are placing orders for pole-line material and miscellaneous equipment. Small orders are being constantly received for miscellaneous distribution transformers to take care of the change in distribution voltage being made by some central-station companies. Sales of watt-hour meters have fallen off somewhat, probably owing to the decrease in building construction. Orders for the direct-current type, however, have increased.

Several orders for material have been received from a utility company in Pennsylvania, including an order for a 40,000-kva. turbo-generator. That company is engaged in carrying out a large program involving the revamping of substations and the building of new ones. The improvement noticed by jobbers last week has continued. The volume of sales has increased and consists essentially of a larger number of orders with no increase in initial quantities.

Business Dull on Pacific Coast—Some Special Orders Placed

BUYERS on the Pacific Coast are very cautious and electrical men are puzzled to account for the prevailing dullness in business since fundamental conditions are sound. The market has been falling, and all standard lines have been somewhat affected. However, some large special orders and inquiries are reported, including 10,000 ignition batteries, fifty reflectors, 10,000 miles No. 9 bare copper wire for various railroads, two carloads 4-in. fiber conduit, 2,000 guy clamps and two carloads of poles for power companies, 20,000 ft. special heater cord, 5,000 attachment plugs and 150 large externally operated switches for electrical equipment manufacturers. Oil company business is good and includes a large assortment of condulets for the Seattle territory and complete equipment for several service stations in San Francisco. Lumber company business is also good except in the Eureka district, where the mills are operating four days per week.

Many requests for quotations covering assorted wiring material have just been received from the state, from central California irrigation companies and from a farmers' telephone company in Nevada, the latter including 300 cross-arms. Lines which apparently predominate over staple material in recent orders are bakelite and other insulating material, show-window reflectors, poles and renewable fuses. Some exceedingly large street-lighting business is expected from the city of Oakland. This will approximate 1,200 poles at a cost of about $250 each. Quotations are now being requested on the first unit of 300 poles which are to be installed this year.

Activities of the Trade

Sundh Electric Company Again Increases Plant Capacity

To take care of its ever-increasing business the Sundh Electric Company, 5 Avenue C, Newark, N. J., manufacturer of electric control apparatus, announces that it is now making another addition to its plant. This is the fourth addition which the company has made since it moved from New York to Newark in 1918. The new addition will be used entirely for office purposes.

"Sales of the company for January, February and March," according to Louis Larsen, manager, "have been very good, particularly during March, which was a record. There has been some slackening up of sales in the past three weeks, but this has not amounted to much."

American Metallurgical Reports Orders and Organization Changes

Recent installations reported by the American Metallurgical Corporation, Boston, manufacturer of electric furnaces, include the following furnaces: Three 20-kw. pot-type units, lead melting, for Pratt & Whitney, Hartford, Conn.; a 20-kw. cyanide pot unit for the Arrow Electric Company, Hartford, and another for the Moore Drop Forging Company, Springfield, Mass.; a paraffin spraying outfit for the Seamless Container Company, Hartford; a 15-kw. tool furnace for Heming-Walsh Manufacturing Company, New Haven, Conn.; a 30-kw. box-type furnace for the OK Tool Company, Shelton, Conn., and another for the Norton Company, Worcester, Mass.; a 68-kw. air heater for the F. N. Burt Company, Buffalo, N. Y., and a 15-kw. tool furnace for the Union Hardware Company, Torrington, Conn.

The Bell & Gossett Company, 117 North Dearborn Street, Chicago, has been appointed Illinois representative of the company, and the Case Hardening Service Company, Cleveland, has been made Ohio representative. A. C. Wright, Springfield, Mass., has been appointed consulting engineer and western New England representative, and Stanley N. Juthe, formerly sales manager, has been elected vice-president in charge of production.

Westinghouse Receives Orders for Power Equipment

Receipt of an order from the Commonwealth Edison Company by the Westinghouse Electric & Manufacturing Company for what is said to be the world's largest frequency converter has just been announced. This set has a capacity of 40,000 kva. and will be used for tying together the Commonwealth Edison Company's 60-cycle and 25-cycle systems. Incorporated in the set will be a motor-operated frame-rotating device, a direct-connected induction starting motor and two direct-connected exciters.

The company has also announced the receipt of a contract for forty-two standard regulators, transformer equipment and a 1,000-kw. motor-generator set from the Los Angeles Gas & Electric Company, amounting to approximately $150,000. Contract has also been closed with the Bolivian government for street-lighting equipment for the palace grounds of La Paz, Bolivia.

American Crossarm and Conduit Builds Kansas City Warehouse

A new distributing warehouse in Kansas City, Mo., has just been completed by the American Crossarm & Conduit Company. This building has been constructed according to the company's own specifications to meet the requirements of its customers. A full stock of standard boards and crossarms and a large quantity of blanks for the manufacture of special arms will be carried at all times, and the policy of the company to ship immediately on receipt of orders, now effective at the Chicago and Newark warehouses, will also be followed at Kansas City. When the new warehouse is opened the company will be in a position to make immediate delivery of its "Rainier Fir" crossarms throughout the Central Western territory.

Circle F Company Purchases Machen Electric Manufacturing

The Circle F Manufacturing Company, Trenton, N. J., has acquired the business of the Machen Electric Manufacturing Company, Philadelphia, and is moving the latter's plant to Trenton.

Through this combination the Circle F company adds to its already extensive line of wiring supplies a line of flush switches of both the push-button and toggle type, thus providing it with a complete line.

Line Material Makes Arrangement for National Distribution

Arrangements have just been completed by the Line Material Company, South Milwaukee, Wis., for the national distribution of its products through fourteen warehouses in various parts of the United States. The stocks carried in these warehouses will include the company's new line of interchangeable high-tension equipment and will be sufficient to meet the demands of the trade. The various warehouses will maintain a large stock at all times, and a system has been prepared whereby all material will be carried in standard-sized packages, which will insure prompt service on emergency shipments and economy in filling routine orders.

The various warehouses and sales offices of the company are at the following points: Allentown, Pa.; Cambridge, Mass.; Charlotte, N. C.; Chicago, Cleveland, Dallas, Tex.; Des Moines, Iowa; Hoboken, N. J.; Indianapolis, Kansas City, Los Angeles, Oakland, Portland, Ore., and Syracuse, N. Y. The present offices and warehouse of the company at 524 East 134th Street, New York City, are being removed to Eleventh and Hudson Streets, Hoboken, N. J. Since April 1 this office has been under the management of M. R. Hoffman, who succeeded P. Van Wagner. Arrangements have also recently been completed by the company whereby it is now associated with Canadian Line Materials, Ltd., of Ontario.

Lockwood, Greene & Company, engineers, announce that their Chicago office has been removed from 38 South Dearborn Street to 602 Wrigley Building, 400 North Michigan Avenue.

The Sibley-Pitman Electric Corporation, Sixth Avenue at Thirteenth Street, New York, electrical jobber, announces that it has appointed H. R. Yackel as manager of the Brooklyn (N. Y.) branch at Clinton and State Streets. Mr. Yackel was formerly a member of the sales department of the New York office.

The Lincoln Electric Company, Cleveland, announces that R. E. Kinkead, former chief engineer of the welder division, has been transferred to the sales department as regional director of sales. His headquarters are in the Lincoln Electric office, Ellicott Square Building, Buffalo.

The Robbins & Myers Company, Springfield, Ohio, announces that it has just added to its line of industrial-size motors the types IF and IA repulsion-induction motors in sizes of ¼ hp. to 7½ hp. inclusive.

The Utility Products Corporation, manufacturers' agent, announces its removal to room 310, 25 Church Street, New York. Some of the companies represented include the Electrical Development & Machine Company, the Barkelew Electric Manufacturing Company, A. S. Wade & Company and the Bell Lumber Company.

The Nizer Corporation, 7424 Mackie Street, Detroit, manufacturer of electric refrigerators, at a recent meeting of its board of directors elected the following permanent officers: H. A. Tremain, chairman of the board and treasurer; Glen P. Cowan, president; Otis A. Glazebrook, Jr., vice-president; A. S. Stephens, vice-president, and James V. Oxtoby, secretary. Several New York men were also elected to the board.

The Tubular Woven Fabric Company, Pawtucket, R. I., announces that it has recently moved its Chicago office and warehouse, which is in charge of William R. Collins, to 841 West Washington Boulevard. The company also announces the opening of an office in Philadelphia at 516 Packard Building, in charge of F. M. MacDuffie. The company's New York office, in charge of F. W. Brower, will also move on May 1 to 50 Church St.

The Utility Lights, Inc., 3819 Frankford Avenue, Philadelphia, manufacturer of standardized lighting products, has been recently organized and will distribute its equipment exclusively through established supply jobbers. The company is confining its activities to those articles which are in steady and universal demand. The various

units are assembled, wired and packed in individual cartons. W. J. Justice is president of the new company.

The Dualite Electric Lamp Corporation has been recently incorporated to manufacture a new type of incandescent lamp containing two separate filaments. Otto B. Shuloff is chairman of the new company, which has been licensed by the General Electric Company and is already manufacturing lamps at St. Mary's, Pa.

The Drake Electric Hoist Company, Friendship, N. Y., has been recently incorporated to take over the electric hoist manufacturing business of the Drake Manufacturing Company and will continue the manufacture of a motor-hoist and traveling crane.

The Electric Products Company, Clarkstone Road, Cleveland, manufacturer of "Wotton" motor generators and switchboards for battery-charging service and special applications, announces the addition to its Cleveland sales force of H. R. Bungay, Jr., who was formerly connected with the electric truck department of the Yale & Towne Manufacturing Company.

The Walworth Manufacturing Company, Boston, announces the formation of the engineering products division to co-operate with the engineering, production and sales departments of the company on the development and distribution of the new Walworth "Sigma" steel valves and fittings for power-plant and oil-refinery service. John M. Olmsted has been appointed general manager of the division with headquarters in Chicago, and Fred W. Duemler, assistant manager, located in New York.

The Pacific Electric Clock Company, 86 Third Street, San Francisco, will soon break ground for a one-story plant on Parker Street, Berkeley, Cal., estimated to cost about $25,000. A general contract for the structure has been let to the Austin Company, San Francisco.

The Westinghouse Electric & Manufacturing Company has announced the following changes in its power department: A. H. Ganshird, formerly manager of the condenser section, is appointed manager of the turbine section, power department, to succeed D. O. Tyllee, transferred to the industrial division, Pittsburgh office. P. L. Fetzer is appointed manager of the condenser section to succeed A. H. Ganshird. J. A. Brown is appointed manager of the generator section to succeed W. Loften, transferred to the Pittsburgh office, central-station division. F. J. Lewis is appointed manager of the substation section to succeed B. H. Lytle, transferred to the Philadelphia office.

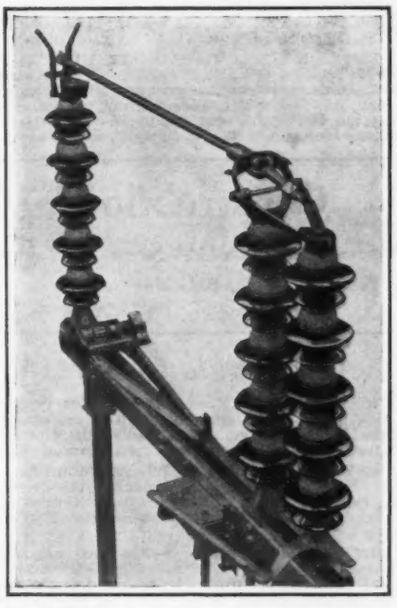
H. J. C. Pearson, No. 320, 101 Marietta Building, Atlanta, consulting electrical engineer, announces the removal of his office to No. 1101 Wynne-Claughton Building, where larger quarters will permit of better service.

The Bristol Company, Waterbury, Conn., manufacturer of electric measuring instruments, has awarded a general contract for a one-story addition, 112 ft. x 118 ft., to be used for laboratory and studio service. It is estimated to cost about $80,000.

New Equipment Available

Motor-Operated 220-Kv. Disconnecting Switch

A motor-operated 220-kv. disconnecting switch making use of a rotating tubular blade which is designed to withstand severe weather conditions has been placed on the market by the Railway & Industrial Engineering Company, Greensburg, Pa. The contact end of the blade is provided with a hollow flat end or "beavertail" of aluminum bronze 4 in. wide, 1¼ in. thick and about 5 in. long, with a shank pressed into and riveted to the end of a tubular copper blade of 2 in. outside diameter. When the switch is closed the contact



MODEL OF 220-KV. SWITCH SHOWING DETAILS OF CONSTRUCTION AND GROUNDING SWITCH

end of the blade is jammed between the tubular copper jaws with a total contact pressure of 400 lb. Wear on the tubular copper jaws is compensated for by facing them with cast aluminum—bronze shoes having a 1¾-in. face. In opening the switch the blade rotates before lifting, thereby releasing the contact pressure and breaking out the ice before the blade is called upon to lift. All the essential mechanical parts of the switch above the insulators are of high-tensile aluminum bronze, while the blade has a double reinforcing of seamless steel tube. The jaws are also reinforced within with seamless steel tubing. A grounding switch as shown in the illustration is an integral part of the equipment.

Speed Reducers for Small Horsepower

A series of speed reducers with gears of the herringbone type for drives of small horsepower has been placed on the market by the Boston Gear Works Sales Company, Norfolk Downs, Mass. Two types are available, one rated at ¼ hp. for driver speeds of 1,000 to 1,800 r.p.m. with ratios ranging from 2.76 to 1 to 6.11 to 1. The other type is rated at ⅓ hp. for the same driver speeds with ratios of 2.90 to 1 to 6.77 to 1. The unit is mounted on a cast-iron base and connected to the motor with a Boston flexible coupling.

Air-Brake Switch

A remote-control air-brake switch of the horizontal-break pole-top type has been developed by the Line Material Company, South Milwaukee, Wis. This switch is intended for light installation and is accordingly made as simple and compact as practicable. The principle of operation consists of the rotating of two insulator members, which support the blade and their respective horns in opposite directions, rapidly and effectively dissipating any possible arcing. A special design of wiping contact actuated by spring pressure insures firm, clean contacts at all times. A sleet hood included as part of the equipment insures positive operation of the switch under any weather conditions.

Safety Entrance Switch

A safety entrance switch with the insulating bases made of an unbreakable molded insulation has been placed on the market by the American Electric Switch Company, Minerva, Ohio. The switch is provided with a card holder, is front-operated, has a spring catch to hold the main cover in closed position and a positive acting catch to hold the fuse door closed. The switch has meter test clips, a disconnecting switch and a line-connecting bus for connecting line terminals to line wires. Each unit is shipped with a blank plate in the meter opening which seals it against the accumulation of dirt during building construction. The net weight of the switch is 9 lb.

Poultry Treater.—The "Uviarc" poultry treater, consisting of a fused-quartz mercury-arc lamp together with the necessary auxiliary apparatus for operation on either 110-volt or 220-volt alternating current, has been developed by the Cooper Hewitt Electric Company, Hoboken, N. J. The unit, which had been previously available for use on 110-volt direct-current service, is of the suspension type and is of such size as can be conveniently installed in the modern poultry or brooder house.

Immersion Heating Unit.—A new immersion heating unit consisting of "helicoil" sheath wire cast into iron has been recently developed by the General Electric Company. This unit was designed for use in oil-tempering baths and melting pots used for melting lead, tin and alloys which will not attack iron. These units are being made with ratings up to 5 kw. and are either sold individually or incorporated in melting pots and tempering baths.

New Trade Literature

HIGH-TENSION EQUIPMENT. — The Line Material Company, South Milwaukee, Wis., is distributing catalog No. 25, covering its complete line of high-tension equipment, including indoor and outdoor busbar supports, busbar clamps, choke coils, remote-control air-break switches, indoor disconnecting and selector switches, terminals and contact nuts, etc. This catalog is issued in sectional form so that additional sections, which will be issued from time to time, may be inserted.

HEAVY-DUTY BUFFERS AND POLISHERS.—The Cleveland Armature Works, Inc., 4732 St. Clair Avenue, Cleveland, has issued bulletin No. 600, supplementing catalog No. 315, which describes and illustrates the "C. A. W." heavy-duty and extra-heavy-duty buffers and polishers.

ELECTRIC RANGES AND APPLIANCES.—A new catalog has been issued by the A. J. Lindemann & Hoverson Company, Milwaukee, which describes and illustrates its "L. & H." electric ranges and appliances, including hot plates, table stoves, heaters, toasters, heating pads, waffle irons, flatirons, testing irons, etc. The company is also distributing a booklet entitled "Range Manual," which contains a short sketch of the method of manufacturing its ranges and the products used and describes the "L. & H. Electrics" temperature-controlling device. The booklet also contains drawings showing the wiring diagrams of its electric ranges and temperature-control device.

SPUR-GEAR SPEED TRANSFORMER. —Bulletin No. T-221 issued by the Hill Clutch Machine & Foundry Company, Cleveland, covers its industrial type of spur-gear speed transformer. Attention is called to other "Hill Clutch" mill equipment products.

LAMINATED BAKELITE.—The Bakelite Corporation, 247 Park Avenue, New York City, is distributing a folder calling attention to the use of laminated "bakelite" and the "bakelite" varnishes and lacquers in the electrical industry. Illustrations are given showing the various devices made of "bakelite."

TRANSFORMERS.—The Moloney Electric Company, St. Louis, has issued bulletin No. 230, covering the Moloney transformers. It contains a brief history of the company and of the transformer. A description of transformer fundamentals and some of the problems of the transformer designer are given and also a set of rules for their successful operation.

PANELBOARDS. — "Good Panelboard Practice" is the title of a booklet issued by the Superior Switchboard & Devices Company, Canton, Ohio, covering its various types of switchboards, panelboards, cabinets, etc. Illustrations are given showing the various types of the "Superior" feeder distribution panels, metering panels, switchboards, pole switches, etc. It also contains specifications for lighting panelboards and panelboard cabinets and also for lighting panelboards with solid neutral branches.

REPULSION-START INDUCTION MOTORS.—The Century Electric Company, St. Louis, is distributing a folder covering its type "RS" induction single-phase motors.

BEARING MATERIAL.— booklet that has been issued by J. E. Loudon & Company, P. O. Box 240, Boston 10, describes the "Mahanite" bearings. It contains a short sketch on the development of "Mahanite" and a list of some of the uses it has been tested for, which include bushings for buffing-machine spindles, punch press and exhaust fan bushings, bearings for grinding-machine spindles, centrifugal hydro-extractor bearings, ammonia pumping wrist-pin bushings, napper and other textile machinery bearings and street-car motor bearings.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Messina, Italy (No. 14,638), for electrical supplies and specialties.

An agency is desired in Turin, Italy (No. 14,642), for power transmission machinery and supplies.

An agency is desired in Rome, Italy (No. 14,639), for electric street-railway equipment.

Purchase is desired in Montevideo, Uraguay (No. 14,595), of steam and motor cranes.

Purchase is desired in Santiago, Chile (No. 14,647), of eight electric cranes.

An agency is desired in Turin, Italy (No. 14,642), for steam and internal combustion engines.

Purchase is desired in Frankfort, Germany (No. 14,635), of medical instruments and apparatus, furniture and electromedical instruments.

New Incorporations

THE TAMPA BAY ELECTRIC COMPANY, Tampa, Fla., has been incorporated with a capital stock of $25,000. The officers are: Roy D. Pedersem, 504 South Oregon Avenue, president, and J. D. Seal, secretary.

THE CIMARRON LIGHT & POWER COMPANY, Sand Springs, Okla., has been chartered with a capital stock of $20,000 by J. P. Thompson and V. A. Shiefelbusch.

THE BEAVER TOWNSHIP ELECTRIC LIGHT & POWER COMPANY, Bouton, Iowa, has been incorporated with a capital stock of $10,000 to erect and operate an electric distribution system. B. C. Gardiner is president, and L. R. Wright, secretary.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LEWISTON, ME. — The Androscoggin Mills, Inc., plans improvements and extensions in its power plant, including the installation of new generating equipment, etc.

RAYMOND, N. H.—The Raymond-Candia Electric Company contemplates the erection of a few miles of transmission lines during this year. George L. Tupper is treasurer.

MANSFIELD, MASS.—The installation of two new series street-lighting transformers in the municipal electric light plant and extending the street-lighting system is under consideration. William Plattner is manager of the municipal electric plant.

PLYMOUTH, MASS. — The Plymouth Electric Light Company contemplates erecting a 22,000-volt transmission line, a distance of 3½ miles, to increase its service at the village of Manomet, town of Plymouth. F. M. Rowell is assistant manager.

SHELTON, CONN.—The Adams Manufacturing Company plans to build a power house at its local mill.

Middle Atlantic States

ALSEN, N. Y.—The Lehigh Portland Cement Company, Allentown, Pa., plans to install electric power equipment in its proposed local cement mill, to cost about $650,000. The company has acquired the local mill of the Hudson Valley Cement Corporation.

BUFFALO, N. Y.—Bids will be received by the Board of Education, Geneso Building, until May 7, for lighting fixtures and other equipment for the Lewis J. Bennett High School.

GENEVA, N. Y.—Authority has been granted the Empire Gas & Electric Company by the Public Service Commission to extend its transmission lines to serve electricity in the towns of Fayette and Throop.

GREECE, N. Y.—The Town Board has contracted with the Rochester (N. Y.) Gas & Electric Corporation for the installation of a street-lighting system, maintained by underground wires, in the Shoremont and Slater subdivisions, covering a distance of about 8 miles, fronting on Lake Ontario.

ITHACA, N. Y. — The Public Service Commission has granted the New York State Gas & Electric Corporation permission to extend its transmission lines to serve electricity in the towns of Scipo and Venice.

ITHACA, N. Y.—The New York State Gas & Electric Company has applied for permission to extend its system to serve the town of Jackson and for approval of exercise of franchise granted by the Town Board.

ST. JOHNSVILLE, N. Y.—Contract has been awarded by the Town Board to the Adirondack Power & Light Corporation, Schenectady, for the installation of electric lamps on the turnpike east and west of the village. The plans call for eighty lamps, lighting about 2 miles of the highway.

SARATOGA SPRINGS, N. Y.—Consent has been granted by the Public Service Commission to four power companies to exercise electric franchise rights in the three towns of Malta, Stillwater and Saratoga in Saratoga County. The companies are the Adirondack Power & Light Corporation, Schenectady, the Dwaas Electric Company Hudson Falls, the Halfmoon Light, Heat & Power Company, Mechanicsville and the Consolidated Electric Company, Greenwich. In each town the town boards had granted franchises to two companies, and the orders of the commission specify the territory which each may serve. In order to furnish electricity in these towns it will be necessary for the Adirondack corporation to erect about 12 miles of transmission lines.

SCHAGTICOOKE, N. Y.—The Half Moon Light, Heat & Power Company has petitioned the Public Service Commission for permission to exercise an electric franchise granted by the Town Board.

SMYRNA, N. Y.—The Earlville (N. Y.) Electric Light Company has acquired the system and property of the Smyrna Electric Light Company. Plans are under consideration for transmission-line extensions.

BAYONNE, N. J.—Arrangements have been made to extend the ornamental lighting system to include Broadway from Fifth to Thirty-sixth Street, instead of from Eighteenth to Twenty-fifth Street. The Public Service Electric & Gas Company has the contract for the work. Arrangements have been made with the company to place the lines in conduits.

ALLENTOWN, PA.—Bids will be received by the Board of Education May 7, for electric work, fixtures, etc., in the new Roosevelt school.

BELLEVUE, PA.—A power house will be built in connection with an addition to the Suburban General Hospital, to cost $150,000. Fred Giffen, Magee Building, Pittsburgh, is architect.

PHILADELPHIA, PA.—Extensions are contemplated to the power house at the plush mills of Baxter, Kelly & Faust, Tioga and C Streets, including the installation of new equipment. The Ballinger Company, Twelfth and Chestnut Streets, is architect and engineer.

WELLSBORO, PA.—The installation of an ornamental lighting system on Main Street is under consideration by the Borough Council.

BALTIMORE, MD. — Application has been filed by the Northern Maryland Electric Company, with the Public Service Commission for permission to erect transmission lines along four routes in Hartford and Cecil Counties.

BALTIMORE, MD.—Three petitions have been filed with the Public Service Commission by the Consolidated Gas, Electric Light & Power Company for permission to extend its transmission lines in Baltimore, Harford and Carroll Counties. The company proposes to erect a transmission line to furnish electricity to Aberdeen Proving Ground and from Magnolia to the Edgewood Arsenal and another branch to Edgewood, Harford Furnace, Creswell, Calvary and Churchville, thence along the Philadelphia road to a point near Fulford. It also proposes to extend its lines to Black Horse, Madonna and Jarretsville.

HUNTINGTON, W. VA.—The installation of a fire alarm system is under consideration. John E. Norvell is chairman of the Fire Prevention Bureau.

BEDFORD, VA.—Extensions are contemplated to the municipal hydro-electric power plant, including the installation of one 438-kva. and one 300-kva. electric generator, one 450-hp. and one 350-hp. waterwheel with governor, motor-operated headgate and hoists, exciters, etc., and three 400-kva. transformers, 22,000/2,300 volts.

WASHINGTON, D. C.—Bids will be received by the Construction Division, Veterans' Bureau, Washington, until May 19, for electrical equipment for elevator at the Veterans' Hospital No. 32, Washington.

WASHINGTON, D. C.—Bids will be received at the office of the General Purchas-

ing Agent, the Panama Canal, Washington, D. C., until May 18 for steel ties, and chains, cable, electric muffle furnace, potato-peeling machine, carbon brushes, etc., as per Circular 1,667.

WASHINGTON, D. C.—Bids will be received by the Quartermaster, Army Medical Center, Washington, until May 15, for power instruments, including steam-flow meters for 8, 10 and 3-in. steam lines, water-flow meter, two CO_2 recorders, two recording stack thermometers, one atmospheric thermometer and one portable Orsott apparatus (Proposal 1).

North Central States

DETROIT, MICH. — The Ford Motor Company contemplates extensions and improvements in its power plant at Dearborn. Albert Kahn, Marquette Building, Detroit, is architect.

GRAND RAPIDS, MICH. — Plans are being prepared for the construction of a new power plant in connection with the plant of the Blackmere Rotary Valve Pump Company on Century Avenue, SW.

HOLLAND, MICH.—The installation of two 500-hp boilers and stokers in the municipal electric light plant is under consideration. Roy B. Champion is manager.

IRON MOUNTAIN, MICH.—Plans are being prepared by the Northern Light, Heat & Power Company, a subsidiary of the Peninsular Power Company, Madison, Wis., to erect a transmission line to furnish electric service in the towns of Dunbar and Goodman.

STANDISH, MICH.—The Standish Electric Light & Power Company is considering improvements to its plant, including the installation of a 60-hp. oil engine (directly connected) and a 100-hp. or 125-hp. belted engine. Nothing definite has yet been decided upon. C. F. Hall is manager.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until May 8, for a motor-generator for the Division of Light and Power.

NORTH KENOVA, OHIO. — Work has started on the construction of a new substation, to cost about $150,000, by the Ohio Power Company, Canton, which will supply additional power facilities for Huntington. Energy to operate this station will be supplied from the large power plant at Philo, near Zanesville, and be transmitted over a high-tension line, now being erected from Rutland to North Kenova, a distance of about 60 miles.

WOODVILLE, OHIO.—The Bruns Lime Works, Inc., plans to install electric power equipment at its proposed local plant, to cost about $1,000,000. S. W. Jameson, Waldorf Hotel, Toledo, is engineer.

EVANSVILLE, IND.—Plans for extensions, to cost about $300,000, at the Southern Hospital for Insane, include a power plant.

HOMER, ILL. — The Homer Electric Light & Power Company has applied for authority to erect a transmission line from a point near the city of Oakwood, 3½ miles south to connect with the Homer-Catlin line.

IOLA, WIS.—The Iola Light, Power & Manufacturing Company contemplates extensions to its distribution system in Iola and the erection of rural electric lines to serve electricity to the farming communities.

LA CROSSE, WIS.—The installation of electrically operated equipment to replace the present steam equipment in the pumping station is under consideration.

WATERTOWN, WIS.—Plans are being considered by the City Council for rehabilitating the street-lighting system throughout the entire city. It is proposed to increase the number of lamps from 208 to 320, using 600, 400, 250 and 100-cp. lamps. The installation of ornamental lamps on three blocks is also being considered. F. A. Vaughn, Inc., 415 Marshall Street, Milwaukee, is consulting engineer.

WISCONSIN RAPIDS, WIS.—The City Council is considering the installation of electric lamps in Robinson Park.

BRAINERD, MINN.—Bids will be received by W. D. McKay, secretary of the Water and Light Board, for the installation of an ornamental lighting system. L. P. Wolff, Globe Building, St. Paul, Minn., is engineer.

DETROIT, MINN.—Bids will be received by E. J. Bestick, City Clerk, until May 4 for the erection of a transmission line from Detroit to Shoreham and distribution lines along Detroit Lake and at Shoreham. The equipment will include one 5-kw. and one 10-kw. distribution transformer. L. P. Wolff, Globe Building, St. Paul, is engineer.

RICE, MINN.—Plans for the construction of a second dam across the Mississippi River at Rice, 15 miles north of St. Cloud, have been announced by the officials of the Minnesota Power & Light Company, Duluth. The proposed dam will cost about $2,000,000 and will develop about 17,000 hp.

RUSHFORD, MINN.—The City Council is considering a bond issue of $28,000, for extensions and improvements in the municipal electric lighting system.

CORRECTIONVILLE, IOWA. — The municipal electric plant has been purchased by L. R. Schlichter, Sioux City, and J. C. Rousch, Onawa. Extensions will be made, including changing the system from direct to alternating current.

HARVEY, IOWA—A special election will be held on May 14 to vote on the proposal to issue bonds for a municipal electric light and power plant.

LE MARS, IOWA.—The La Mars Water & Light Company contemplates building a substation this year. M. W. Shupe is local manager.

MILLERTON, IOWA—The City Council is considering a bond issue for the installation of a municipal electric lighting system.

ST. CHARLES, IOWA—The Three Rivers Light & Power Company plans to erect a new transmission line to the towns of Carlisle, Prole, Churchville and Wick. C. A. Willett is manager.

NELIGH, NEB.—The local electric light plant of the S. E. Gilman Mill Company is reported to have been acquired by the Tri-State Utilities Company, Minneapolis. The deal, it is said, also includes the Gilman electric plant at Valentine.

HOLTON, KAN.—Plans are under consideration for the installation of a 400-hp. oil engine to drive a 275-kw., 2,300-volt General Electric generator in the municipal electric light plant. W. H. Bean is superintendent.

MULVANE, KAN.—The installation of a new generating unit (probably 300-hp., oil-engine-driven) is under consideration. F. E. Shaw is superintendent.

OAKLEY, KAN.—The rebuilding of the municipal electric distribution system is under consideration. K. W. Davis is city clerk.

Southern States

LAKELAND, FLA.—The contract for extensions to the municipal electric system has been awarded to the W. T. Hadlow Company, Jacksonville, for $63,893.

CHATTANOOGA, TENN.—The Signal Mountain Portland Cement Company, James Building, plans to build a steam-operated electric power plant at its mill.

ENSLEY, ALA.—Steps have been taken by the Associated Business Men for the installation of an ornamental lighting system in the business district.

FLORENCE, ALA.—Bids will be received by the United States Engineer, Florence, until May 4 for the erection of a transmission line from Wilson Dam to Nitrate Plant No. 2.

LEEDS, ALA.—The Alabama Power Company, Birmingham, plans to erect a transmission line from its Warrior power plant to Leeds, via Red Mountain, where a substation will be built. The entire cost is estimated at $300,000.

MEMPHIS, TENN.—The Memphis Power & Light Company contemplates the erection of transmission lines in suburban districts, including Crawfordsville, Marion and vicinity, coverng about 100 miles.

MERIDIAN, MISS.—The Southeastern Power & Light Company has acquired the properties of the Meridian Light & Railway Company, operating at Meridian and Hattiesburg. Extensions in transmission lines are contemplated.

BLYTHEVILLE, ARK. — Arrangements are being made by the Missouri-Arkansas Power Company for the erection of a high-tension transmission line between Lake City, Blytheville and Paragould, to cost about $350,000. The company has recently acquired the electric plants at Lake City and Leachville and has been granted a franchise at Manila, where the electric plant was destroyed by fire early this year. It is proposed ultimately to extend the transmission lines to the Ozarks, where the company has acquired valuable water rights and proposes to build a hydro-electric plant.

SHERIDAN, ARK.—The Arkansas Light & Power Company, Pine Bluff, has acquired the municipal lighting plant and plans to remodel the structure for a substation. Extensions will be made in transmission lines. The company is also planning improvements in the lighting plants recently acquired at Beebe, Kensett, Judsonia and McRae, Ark.

WEST MONROE, LA.—The municipal electric plant has been acquired by the Louisiana Power & Light Company, Pine Bluff, Ark., which plans extensions in transmission lines in this section.

DAWSON, OKLA.—Plans for the proposed local cement of the Mid-Continent Portland Cement Company, Atlas Building, Tulsa, to cost about $1,500,000, include a power house.

ENID, OKLA.—The City Council has called a special election to vote on the proposal to issue bonds for a municipal electric lighting system.

ORLANDO, OKLA. — The proposal to issue $12,000 in bonds for a municipal electric lighting plant was defeated at an election held recently.

CELINA, TEX.—The Texas Power & Light Company, Dallas, plans extensions and improvements in the local street-lighting system.

Pacific and Mountain States

EVERETT, WASH.—Steps have been taken by the Chamber of Commerce and other civic bodies to secure a new street-lighting system throughout the city.

LONGVIEW, WASH.—The Longview Public Service Company contemplates the construction of a substation at Hemlock and Tenth Streets.

SEATTLE, WASH.—Plans have been completed for the electrification of the main line of the Great Northern Railway Company through the Cascades, a distance of 30 miles, at a cost of about $1,500,000. Electricity will be obtained from 6,500-hp. hydroelectric plant that the company installed in the Tumwater Canyon, on the Wenatchee River. The output of this plant will be increased to 10,000 hp.

PORTLAND, ORE. — Plans are being prepared for the installation of an improved street-lighting system in the Broadway district.

CHICO, CAL.—The City Council is considering the installation of an ornamental lighting system on a portion of Second Street.

EL CERRITO, CAL.—The Board of City Trustees is considering a bond issue of $12,000 for the installation of an electric fire-alarm system.

LOS ANGELES, CAL.—The City Council has adopted ordinances for the installation of ornamental lamps, using concrete standards, on portions of Burck Place, Laurel Avenue, Jefferson Street and Sixty-second Street. Plans to install additional ornamental lamps in the Hollywoodland district are under consideration.

OROVILLE, CAL.—A resolution providing for establishing a municipal electric plant has been adopted by the City Trustees. It is proposed to purchase the present distributing system and retail energy purchased by the city.

SACRAMENTO, CAL.—The City Council is considering the installation of an ornamental lighting system on a portion of sixteenth Street.

SAN DIEGO, CAL.—The City Council is considering plans for the installation of an ornamental lighting system on University Avenue, from Pueblo to Euclid Avenues.

LEWISTON, IDAHO—The City Council has approved the proposal of the Inland Power & Light Company, Portland, Ore., to build a hydro-electric power plant on the Clearwater River, with initial output of 13,300 hp., to cost about $2,000,000 with transmission system. Stevens & Koon, Spaulding Building, Portland, are engineers.

PROVO, UTAH—The installation of an ornamental lighting on Center Street, covering six blocks, is under consideration.

Canada

CALGARY, ALTA.—Plans are under consideration by the Electric Light and Power and Street Railways Departments for reconstruction work in the electric and street railway systems this summer, to cost about $150,000.

QUEBEC, QUE.—The Public Service Commission has granted the Compagnie Electric de Montmagny permission to erect transmission lines which will connect St. Jean, Port Joli, St. Aubert, St. Roch des Aulnaies, Ste. Louise, Ste. Anne de la Pocatière and St. Pacome.

RIVIERE AUX CHIENS, QUE.—The Montmorency Power Company plans to begin work soon on a 6,000-hp. hydro-electric development at Riviere aux Chiens.

Electrical Patents

Announced by U. S. Patent Office

(Issued March 31, 1925)

1,531,805. OSCILLATION GENERATOR; R. C. Mathes, New York, N. Y. App. filed July 10, 1920. Vacuum-tube type.

1,531,81[illegible]. ELECTRIC FURNACE; F. J. Peterson, Detroit, Mich. App. filed Dec. 26, 1923. Mixes metals for making alloys.

1,531,816. ELECTRICAL CONNECTOR; T. C. Russell, Chicago, Ill. App. filed Aug. 30, 1923. Spring jaws or socket type.

1,531,824. METHOD OF MAKING ELECTRICALLY WELDED PIPE COUPLINGS; C. S. Smith, Milwaukee, Wis. App. filed Jan. 12, 1923.

1,531,827. FILLER ROD FOR FUSION WELDING; J. C. Armor, West View Borough, Pa. App. filed Dec. 6, 1922.

1,531,828. WELDING ROD OR WIRE AND PROCESS AND APPARATUS FOR MANUFACTURING THE SAME; J. C. Armor, West View Borough, Pa. App. filed Dec. 6, 1922.

1,531,841. SWITCH-CONTACT DEVICE; E. A. Breitenbach, New York, N. Y. App. filed April 16, 1923. For securing lead wires to terminals.

1,531,853. MOTOR-CONTROL SYSTEM; C. R. Fisher, Rogers City, Mich. App. filed Feb. 27, 1922. For controlling reversing direct-current motors.

1,531,858. METHOD OF AND APPARATUS FOR MAKING ELECTRIC STEEL; J. W. Galvin, Springfield, Ohio. App. filed April 28, 1920.

1,531,872. ELECTRICAL REGULATING APPARATUS; B. E. O'Hagan, Swissvale, Pa. App. filed Oct. 26, 1923. For regulating, or keeping constant, the electrical output of generators.

1,531,879. ELECTRIC LIGHTER FOR CIGARS AND CIGARETTES; E. Rinderspacher, Buenos Aires, Argentina. App. filed March 15, 1920.

1,531,914. PARALLELING ELECTRO-DYNAMIC MACHINES; A. C. Finney, Schenectady, N. Y. App. filed May 27, 1924.

1,531,917. ELECTRIC SWITCH; H. G. French, Schenectady, N. Y. App. filed Nov. 11, 1922. Improved flexible contact as used in the truck type.

1,531,920. INDUCTION-MOTOR WINDING; H. Geisenhoner, Schenectady, N. Y. App. filed Nov. 1, 1922. Squirrel-cage type.

1,531,936. ELECTRICAL ATTACHMENT PLUG; P. E. Herrmann, New York, N. Y. App. filed Nov. 11, 1922.

1,531,939. SWITCH GEAR FOR CONTROLLING ELECTRIC MOTORS; J. A. Hirst and Percy S. Brook, Chester, England. App. filed Sept. 17, 1920.

1,531,949. SUPPORTING BRACKET; C. S. Johnson, Frederick, Md. App. filed Oct. 11, 1921. For corner construction.

1,531,966. ELECTRICAL GLOW DEVICE; G. M. MacKay, Schenectady, N. Y. App. filed Jan. 26, 1920. Incandescent lamp.

1,531,971. PROTECTIVE DEVICE; F. W. Peek, Jr., Pittsfield, Mass. App. filed May 20, 1918. Against lightning discharges, etc.

1,532,003. RELAY DEVICE; O. C. Traver, Schenectady, N. Y. App. filed May 26, 1920. Instantaneous or time limit type.

1,532,004. PROTECTIVE SYSTEM; R. Troger, Zehlendorf, Germany. App. filed Feb. 14, 1923. Selective for the control of faulty section of a power line.

1,532,036. SYSTEM OF MOTOR CONTROL; A. K. Bushman, Schenectady, N. Y. App. filed Aug. 15, 1922. For maintaining a predetermined speed relation of a plurality of separate driving motors.

1,532,038. MAGNETIC BLOW-OUT; E. R. Carichoff, Schenectady, N. Y. App. filed Feb. 27, 1920. On circuit breaker.

1,532,045. LIGHT-FLASHING RELAY; A. H. Davis, Buffalo, N. Y. App. filed July 6, 1923.

1,532,052. TREATMENT OF IRON OR STEEL IN ELECTRIC FURNACES; A. E. Greene, Chicago, Ill. App. filed Jan. 2, 1909.

1,532,073. ELECTRIC HEATER; W. Penzold, Hanover, Germany. App. filed July 22, 1924. For boiling water and for generating steam..

1,532,081. ELECTRIC SWITCH; W. K. Rankin, Schenectady, N. Y. App. filed Nov. 14, 1922. Third-break type.

1,532,086. ELECTRIC BAKING APPARATUS; J. L. Shroyer, Chicago, Ill. App. filed June 15, 1923.

1,532,090. INDUCTION FURNACE; M. Unger, Pittsfield, Mass. App. filed Feb. 16, 1921. For melting highly conductive non-ferrous metals.

1,532,098. ELECTRIC WIRING CONNECTION AND SUPPORT THEREFOR; E. G. Anderson, Evanston, Ill. App. filed April 14, 1922. For connecting wiring of branch circuit or circuits to wiring of main circuit.

1,532,112. ELECTROPLATING APPARATUS; C. E. Jones, Schenectady, N. Y. App. filed Sept. 22, 1923. For rapid handling of large quantities of small objects.

(Issued April 7, 1925)

1,532,130. CONTROLLING MECHANISM; O. C. From, New York, N. Y. App. filed Feb. 5, 1924. For use in telephone and similar systems.

1,532,138. ELECTROMAGNETIC BRAKE; H. E. Hodgson, Milwaukee, Wis. App. filed April 12, 1924.

1,532,169. METHOD OF AND MEANS FOR MEASURING TRANSMISSION; F. H. Best, Westfield, N. J. App. filed Sept. 6, 1919. For determining the transmission efficiency of electrical devices and circuits, as telephone lines.

1,532,172. MEANS FOR RECEIVING WEAK SIGNAL CURRENTS; J. R. Carson, New York, N. Y. App. filed June 18, 1918. On telegraph systems.

1,532,189. THERMOSTATICALLY CONTROLLED HEATING ELEMENT; L. H. Lamont, Chicago, Ill. App. filed Sept. 18, 1922.

1,532,200. PLUG CONTACT; W. H. Petersen, Gamla Posten, Ludvika, Sweden. App. filed Jan. 11, 1923. As used on measuring and testing instruments.

1,532,207. SIGNALING SYSTEM; L. J. Stacy, Bloomfield, N. J. App. filed Sept. 15, 1921. Means for transmitting an audible ringing signal.

1,532,208. ELECTRIC LAMP SOCKET; H. L. Strongson, Brooklyn, N. Y. App. filed Dec. 4, 1922. Multiple receptacle.

1,532,212. MAGNETIC LATCH MECHANISM; G. O. Wilms, Milwaukee, Wis. App. filed April 27, 1921.

1,532,216, 1,532,217. TELEPHONE SYSTEM; G. A. Yanochowski, Chicago, Ill. App. filed Sept. 12, 1921. Divided switchboard system.

1,532,219. CONTROLLER FOR ELECTRICALLY HEATED FLATIRONS; E. Anthony, Seattle, Wash. App. filed Nov. 29, 1920.

1,532,220. PLUG BOX AND PLUG; F. P. Arrousez and W. C. Hollins, Los Angeles, Cal. App. filed May 11, 1920. As used in motion-picture studios.

1,532,224. CURRENT-COLLECTING APPARATUS; R. S. Blair, Sound Beach, Conn. App. filed April 19, 1921. For electric locomotives and other electrically propelled vehicles.

1,532,235. COMBINED SWITCH AND FUSE; W. G. Dexter, Brooklyn, N. Y. App. filed March 8, 1922.

1,532,241. METERING CIRCUIT FOR TELEPHONE SYSTEMS; A. Flad, Berlin, Germany, and F. Lubberger, Schmargendorf, Germany. App. filed July 10, 1922.

1,532,252. MEANS FOR PROVIDING AND RELEASING OIL IN BATTERY SOLUTIONS; M. L. Martus, Woodbury, Conn., and E. H. Becker and H. B. Schoenmehl, Waterbury, Conn. App. filed May 24, 1924.

1,532,263. CONTAINER; O. O. Reiser, Forest Park, Ill. App. filed June 16, 1924. For storage battery.

1,532,287, 1,532,288. ALTERNATING-CURRENT MOTOR; H. Welchsel, St. Louis, Mo. App. filed March 17, 1924. Capable of operating both as an induction motor and as a synchronous motor.

1,532,336. WIRELESS-TELEGRAPH CALLING DEVICE; W. H. Nottage, Ruislip, England, and T. D. Parkin, Chelmsford, England. App. filed Dec. 18, 1920.

1,532,345. ELECTRIC SWITCH; G. F. Rauch, Pukwana, S. D. App. filed Oct. 26, 1922. Time switch primarily for operating whistles or gongs.

1,532,351. DYNAMO-ELECTRIC MACHINE; D. L. Shea, St. Louis, Mo. App. filed Oct. 20, 1921. Forced ventilation.

1,532,356, 1,532,357. METHOD AND APPARATUS FOR RADIO SIGNALING; R. A. Weagant, Douglas Manor, N. Y. App. filed Feb. 7, 1919.

1,532,388. WIRELESS-TELEGRAPH APPARATUS FOR AËROPLANES; H. M. Dowsett, London, England. App. filed Aug. 16, 1921.

1,532,391, 1,532,392. MEASURED-SEVRICE TELEPHONE SYSTEM; J. Erickson, Chicago, Ill. App. filed May 25, 1922.

1,532,438. GRAPHIC ELECTRIC METER; L. A. Paine, Toronto, Ontario, Canada. App. filed Aug. 27, 1921.

1,532,449. LIFTING MAGNET; J. E. Sederholm, St. Paul, Minn. App. filed Jan. 7, 1922.

1,532,452. TRAFFIC SIGNAL; G. C. Spaller, Cleveland, Ohio. App. filed May 12, 1923.

1,532,462, 1,532,463. ELECTRICAL MASSAGING INSTRUMENT; A. Winterfield, New York, N. Y. App. filed Oct. 28, 1920.

1,532,498. ELECTRIC INDUCTION WATER HEATER; C. Kaiser, Atlantic City, N. J. App. filed March 25, 1922.

1,532,502. ELECTRIC HEATER; J. L. Lawrence, San Francisco, Cal. App. filed Aug. 15, 1922. Portable.

1,532,513. TELEPHONE CIRCUIT; E. S. Pridham and P. L. Jensen, Oakland, Cal. App. filed May 1, 1922. For use especially with an electro-dynamic receiver.

1,532,524. COMBINED CIRCUIT BREAKER AND FUSE RECEPTACLE; H. C. Wendle, New Paris, Pa., and M. Holsopple, Seanor, Pa. App. filed June 16, 1922. Safety type.

1,532,558. RESISTANCE-HEATER SUPPORT; R. E. Talley, Irwin, Pa. App. filed Aug. 4, 1922.

1,532,599. ELECTRIC FURNACE; W. E. Moore, Beaver, Pa. App. filed Sept. 5, 1919. Arc type.

1,532,610. ELECTRIC HAIR-SINGEING TOOL; H. E. Taylor, Ogema, Saskatchewan, Canada. App. filed Feb. 28, 1923.

1,532,643. CALLING DEVICE; F. L. Baer, La Grange, Ill. App. filed Dec. 30, 1921. For automatic telephone system.

1,532,655. IMPULSE TRANSMITTER FOR AUTOMATIC TELEPHONE SYSTEMS; J. Erickson, Chicago, Ill. App. filed March 18, 1921.

1,532,664. AUTOMATIC TELEPHONE SYSTEM; S. R. Smith, London, England, and J. Savin, Liverpool, England. App. filed Jan. 3, 1921.

1,532,676, 1,532,677. AUTOMATIC CALLING DEVICE; J. G. Blessing, Chicago, Ill. App. filed Jan. 21, 1921. Impulse transmitter for use in an automatic telephone system.

1,532,680. METHOD OF SUPPLYING CURRENT FOR ARC WELDING AND APPARATUS THEREFOR; H. A. Brown and A. M. Bennett, Erie, Pa. App. filed Nov. 12, 1920.

1,532,739. CIRCUIT ARRANGEMENT FOR MULTIPLEX CABLE TELEGRAPHY AND TELEPHONY; H. Fassbender, Charlottenburg, Germany, and E. Habann, Waidmannslust, Germany. App. filed Aug. 22, 1921.

1,532,773. METHOD OF MOUNTING THE HEATING ELEMENTS IN ELECTRIC HEATING APPARATUS; E. R. I. Nordstrom and E. O. Johansson, Stockholm, Sweden. App. filed May 19, 1923.

1,532,786. SPARKLESS CIRCUIT CONNECTION; H. Sundhaussen, Bredeney-on-the-Ruhr, Germany. App. filed Feb. 19, 1915. For sparkless breaking of a circuit influenced by self-induction and intended for currents of short duration.

1,532,833. ELECTRIC WELDING JIG; J. W. Meadowcroft, Philadelphia, Pa. App. filed Sept. 6, 1922.

1,532,836. THIRD-RAIL SUPPORT AND PROTECTION BOARD BRACKET; E. E. Schmid, Hollis, N. Y. and W. H. Schneider, Freeport, N. Y. App. filed April 25, 1924.

1,532,842. PROCESS OF UNITING THICK METAL PLATES BY ELECTRIC WELDING; R. Stresau, Wauwatosa, Wis. App. filed Jan. 12, 1923.

1,532,846. ELECTRICAL CONDENSER; C. H. Thordarson, Chicago, Ill. App. filed March 31, 1920. For high-tension currents, utilizing oil as a cooling medium.

1,532,849. SEMI-AUTOMATIC TELEPHONE SYSTEM; B. D. Willis, Oak Park, Ill. App. filed June 22, 1918.

1,532,854. AUTOMATIC TELEPHONE SYSTEM; A. Anderson and W. A. Chapin, Chicago, Ill. App. filed Dec. 23, 1920.

1,532,855. ELECTRIC SWITCH; C. E. Anderson, Stratford, Conn. App. filed Dec. 22, 1921. Tumbler type.

1,532,871. LEVEL-INDICATING DEVICE; F. G. Bloch, Boblingen, Germany. App. filed Dec. 1, 1920.

1,532,888. TELEPHONE SYSTEM; H. D. Currier and W. G. Shull, Chicago, Ill. App. filed July 15, 1920. In which link and trunk circuits are used for interconnecting subscribers' lines.

1,532,903. WATER HEATER; A. J. Kercher, Berkeley, Cal. App. filed April 10, 1923.

1,532,951. BREAD TOASTER; D. A. Rogers, Minneapolis, Minn. App. filed June 4, 1923.

1,532,964. MEANS FOR RADIO-SIGNALING SHIPS DURING A FOG; C. Valguarnera, Palermo, Italy. App. filed Aug. 9, 1924.

1,533,612. DRY-CELL BATTERY; H. M. Koretzky and B. H. Teitelbaum, Brooklyn, N. Y. App. filed Dec. 17, 1919. Used in connection with flashlights or analogous devices.

1,533,079. AUTOMATIC TELEPHONE SYSTEM; R. G. Richardson, Chicago, Ill. App. filed Feb. 6, 1920.

(Issued April 14, 1925)

1,533,090. ELECTRIC HEATER; E. W. Black, Spokane, Wash. App. filed Feb. 15, 1924. Bread toaster.

1,533,091. DUPLEX SIGNALING SYSTEM; O. B. Blackwell, Garden City, N. Y. App. filed Nov. 14, 1919.

1,533,095. AUTOMATIC SIGNALING DEVICE; J. Bulewich, Palmer, Mass., and J. Nosarzewski, Chicopee, Mass. App. filed Sept. 27, 1921. Traffic signal.

1,533,096. RESISTANCE UNIT; F. H. Bullinger, Yonkers, N. Y. App. filed Aug. 24, 1922. Tubular type.

1,533,098. ELECTRIC HEATER; S. M. Carmean and J. H. Carmean, Kansas City, Mo. App. filed April 11, 1924. Combined fan and heating elements.

1,533,105. ELECTRIC SIGNALING; H. C. Eggers, Minneapolis, Minn. App. filed Jan. 5, 1920. Operating circuit for telegraph sounder.

Financial and Corporate

Utility Market Quieter

Gains Outnumber Losses for Week, but Price Changes in General Were Small

THE market in power and light stocks nowadays is following somewhat the same course as that in railroad and industrial shares, which is to say that almost every week brings a mixture of gains and losses. In the week under review the price changes were small for the most part, but the gains outnumbered the losses. A spectacular rise in American Light & Traction Company's stock was perhaps the outstanding feature of the trading, the price of that issue having improved its position by something like fourteen or fifteen points. Not long ago when the directors took action on the dividend the stock fell to lower levels, but on analysis of the asset position some investors are beginning again to interest themselves in the issue. Declaration of a dividend by Middle West Utilities weakened the market position of the stock on the theory that stock should be sold now that the good news is out. It lost about seven points on the week.

The advance in American Light & Traction, however, and the decline in Middle West Utilities were exceptions rather than typical of the list. For the most part the net changes of the week were small. Commonwealth Power Corporation, for example, improved its position all through the week, but the net gain was something like a point or so only. United Light & Power class A rose four points.

On the listed market attention was turned again to Virginia Railway & Power, which crossed 100 for the first time this year and in which interest has spread. American Water Works & Electric got to a new recent high above 48 as demand for the stock grew with the improvement in earnings and accumulation by sources that have not been revealed.

New York-New Jersey Superpower and Staten Island Edison

The New York Public Service Commission has denied the application of the New York-New Jersey Superpower Connecting Corporation for consent to purchase the capital stock of the Staten Island Edison Corporation. It is held that such purchase is prohibited under Section 70 of the Public Service Commission law, which forbids a foreign stock corporation to hold the stock of a domestic gas or electric corporation operated within the territory formerly under the jurisdiction of the First District Public Service Commission.

The New York-New Jersey Superpower Connecting Corporation was chartered this spring under New Jersey laws with an original capital of $1,000. The subscribers to its stock were J. E. Brand of Plainfield, N. J.; L. Tarantino of New York City and John R. Turner of Basking Ridge, N. J. H. C. Hopson is vice-president of the corporation. Its principal place of business is 15 Exchange Place, Jersey City, and its New York City office is 61 Broadway. The corporation filed a certificate of statement and designation in the office of the Secretary of State at Albany on March 5 to enable it to do business in New York State.

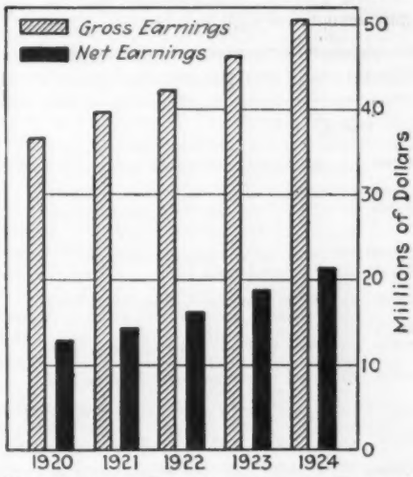
Byllesby Group in Good Position to Grow

Large Investments in Standard Gas & Electric Properties in Recent Years Should Enable Utility to Expand Without Much Further Outlay

BY PAUL WILLARD GARRETT

THE Standard Gas & Electric Company, the holding company associated with the name of the late Colonel Henry M. Byllesby, has had a remarkable growth during the last five years. Gross earnings of the affiliated companies have increased by steady yearly advances from $36,686,128 in 1920 to $50,542,824 in 1924, and in that same period, as the chart also shows, net earning grew from $12,911,139 to $21,451,391. Improvement in net earnings was as persistent and as steady as that in gross.

It is scarcely correct to say that the Standard Gas & Electric properties all lie west of the Mississippi, but such a statement would not be far from the truth. The outstanding operating companies that appear in the Byllesby group are, of course, the Northern States Power Company and the Oklahoma Gas & Electric Company. Minnesota and Oklahoma, the two states served primarily by these two utilities, are the ones in which the major part of the service is performed. Other important properties of the group serve Colorado, Oregon, Washington and California and, to name the most easterly state in the group, Kentucky.



EARNINGS OF STANDARD GAS & ELECTRIC PROPERTIES SHOW PERSISTENT IMPROVEMENT

One of the striking discoveries in a study of the detailed financial operations of the subsidiaries, particularly such a one as the Oklahoma Gas & Electric Company, over recent years is that large funds have been plowed from earnings back into the property. Seeing the inevitable growth just ahead, the management in the last two or three years has been preparing to handle this business by expenditures made with an eye on the distant rather than the immediate future. It means that the utility in the future will be able to handle a substantially greater volume of business as it is offered without making a proportionate increase in the investment.

What John J. O'Brien, president of the Standard Gas & Electric Company, had to say on this point in the company's annual report recently published is significant: "Joined with the apparently excellent prospects for the increased sale of services supplied by operating companies is the fact that these companies are equipped with large modern plants, containing in many cases surplus capacity which can supply much additional business without a proportionate increase of investment. To a considerable extent this is true also of transmission equipment. The operated companies are in splendid position to meet increased demand, lead in the development of the territories served and produce increased returns on the large capital investments of the past two years. During 1923 and 1924 the volume of construction involving new plants, improvements, transmission and distributing equipment was unprecedented. The total amount expended for these purposes was $31,388,261 in 1923 and $30,939,715 in 1924. These figures may be compared with a construction budget of $22,948,000 for 1925, which will be devoted largely to transmission and distributing equipment needed to reach and serve additional customers. The outstanding feature of the construction program of 1924 was the large volume of new electric generating capacity completed and put into service."

Last year was the best in the history of the Standard Gas & Electric Company. Gross earnings increased 17.35

per cent and net earnings 27.99 per cent over the year before. This improvement and the increased interest in the stocks now that they are listed on the New York Stock Exchange calls attention to the financial structure. The company has extinguished its secured funded debt and has greatly reduced the proportion of funded debt to its total capitalization. The funded debt as of December 31, 1924, including the convertible debentures and twenty-year notes, aggregated $27,817,100 and the total capital stock $30,000,000.

Annual Reports of Electric Light and Power Companies

The annual report of the Northern States Power Company, which in point of earnings now ranks among the ten largest utility companies in the United States, for the year ended December 31, 1924, shows that gross earnings of the properties for the full-year periods increased approximately 5 per cent as compared with the previous year and net earnings 10.6 per cent. The figures show a constantly reducing ratio of operating expenses to gross earnings. In 1924 this figure was 53.4 per cent, as compared with 57.5 per cent in 1923 and 62.1 per cent in 1920.

Gross earnings totaled $20,227,211, as compared with $15,489,791 for the previous year, and net earnings $9,417,316, as compared with $6,580,992 for 1923.

These figures do not include for the full period properties acquired during the year. The increase in gross is largely the result of additional properties acquired in 1923 but not actually merged with the company until the close of that year. Total customers increased 14,301 to 271,462 during the last year and electrical energy output for 1924 was 691,099,810 kw.-hr., as compared with 657,412,482 in 1923.

In the construction of new plants, transmission and distributing facilities, improvements and extensions the year 1924 was by far the largest in the history of the company. Total expenditures for these purposes were $15,823,402.

Pacific Gas & Electric Company for the year 1924 reports gross operating revenue of $44,451,586, as compared with $39,321,535 for the previous year. The increase establishes a new maximum in the company's unbroken record of growth over the past nineteen years. The net gain in active meters during 1924 was 53,582, making the total at the end of the year 763,617. Although the cost of operation increased by $5,222,810 during the year, net operating income amounted to $16,248,490, an increase of $420,365 over 1923. Total net income from all sources, representing the balance available for the payment of interest charges, depreciation and dividends, aggregated $16,732,323, or $253,991 in excess of 1923 results. Sales of electrical energy in kilowatt-hours advanced from 1,199,063,000 in 1923 to 1,333,854,000 in 1924.

The Cumberland County Power & Light Company in its annual report for the year ended December 31, 1924, shows gross income of $3,857,706, against $3,771,968 in 1923, and net income of $672,332, as compared with $550,901 in the previous year.

The Washington Water Power Company for the year ended December 31, 1924, reports gross revenue of $5,299,927, as compared with $5,087,336 in 1923, and net income from operation of $3,094,159, against $2,957,840 during the previous year. Kilowatt-hours generated and purchased increased from 413,148,900 in 1923 to 432,801,680 in 1924. At the end of the year the com-

New Issues Total $47,108,000

Twenty-two Electric Light & Power Companies Participate in Financing During April—Lower Rates a Feature

NEW offerings of bonds, notes and stocks by the electric light and power companies of the country during the month of April amounted to only $47,108,000, a figure representing less than one-third of the total recorded for March and less than one-half of the total for April, 1924. Twenty-two individual issues contributed to this total, but eleven of this number amounted to only $1,000,000 or less. The largest single piece of financing was the ten-million-dollar offering of the Columbia Gas & Electric Company in the form of gold notes offered at 100. Long-term securities predominated and the rate of return yielded the investor fell to 5.96 per cent from 6.20 per cent in March.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN APRIL

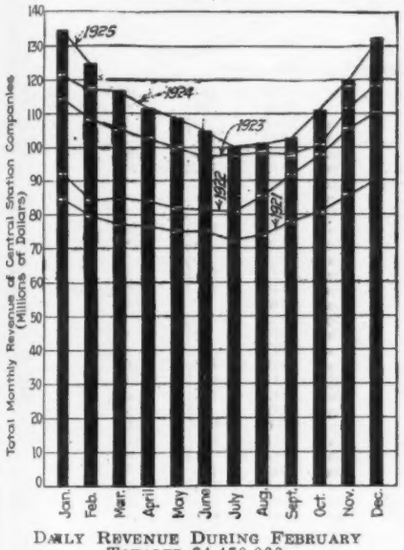
Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Jersey Central Power & Light Co.	$4,000,000	..	Cumulative preferred stock	To finance cost of merger and to retire outstanding obligations of constituent companies	7	97	7.20
Central Power & Light Co. (Ark.)	1,000,000	20	First lien and refunding gold bonds	To reimburse company for additions, extensions and improvements to the properties	6½	100	6.50
Pennsylvania Electric Corp.	2,500,000	30	Sinking-fund gold debentures	To acquire notes pledged as security	6	93	6.50
Associated Gas & Electric Co. (N. Y.)	7 520,000	..	Preferred stock	To pay in part cost of acquisition of additional properties	6	84	7.14
Alabama Power Co.	3,000,000	26	First mortgage lien and refunding gold bonds	Construction	5	94½	5.40
Central Massachusetts Light & Power Co.	250,000	..	Preferred stock	New capital	6	95	6.32
Illinois Northern Utilities Co.	668,000	32	First and refunding mortgage gold bonds	Additions and betterments	5	90	5.70
Central States Electric Co. (Ia.)	460,000	25	First mortgage and refunding gold bonds, series A	To retire bonds, to pay for properties recently acquired and for other corporate purposes	6	99	6.08
Public Service Co. of Oklahoma	1,000,000	..	Cumulative prior lien stock	To cover cost of acquiring additional property	7	97	7.22
Erie County Electric Co. (Pa.)	1,000,000	35	General and refunding mortgage gold bonds, series A	To pay in part for new unit, pay off unfunded debt and add to working capital	5½	99½	5.53
Iowa Southern Utilities Co.	1,000,000	..	Cumulative preferred stock	To retire notes	7	95	7.36
Columbia Gas & Electric Co. (N. Y.)	10,000,000	3	Gold notes	Capital expenditures	5	100	5
Columbus, Delaware & Marion Elec. Co. (Ohio)	1,250,000	10	Convertible debenture gold bonds, Series A	Additions	6	96	6.50
Electrical Securities Corp.	1,000,000	30	Collateral trust sinking fund gold bonds		5	96	5.26
Mountain States Power Co. (Ore.)	2,000,000	13	First mortgage gold bonds, series B	To reimburse for additions and extensions	6	100	6
Bear Valley Utility Co. (Cal.)	110,000	19	First mortgage sinking fund gold bonds, series A	To reimburse company for expenditures on additions	7	100	7
Binghamton Light, Heat & Power Co. (N. Y.)	1,500,000	21	First refunding mortgage gold bonds		5	97	5.25
Interstate Electric Corporation	500,000	8	First lien collateral sinking-fund gold bonds		6	97¾	6.35
Nebraska Electric Power Co.	350,000	5	First mortgage gold bonds, series A	To pay off existing indebtedness, to consolidate the properties and for other corporate purposes	6	100	6
Georgia Railway & Power Co.	4,000,000	..	Cumulative first preferred stock	To pay for additions and improvements and for acquiring additional property	7	98	7.15
West Penn. Power Co.	6,500,000	38	First mortgage gold bonds	To retire bonds and for additions	5	97½	5.18
Interstate Power Co.	2,500,000	19	First mortgage gold bonds, series B	Acquisition of property and other corporate purposes	6	99	6.10
Total	$47,108,000						

pany had 5,443 stockholders, including those purchasing stock on deferred payments.

The income account statement of the Eastern New York Utilities Corporation for the year 1924 shows total operating revenue of $1,107,055, as compared with $1,093,536 in 1923, and operating expenses, including taxes, retirement reserve and rentals, of $915,784, against $927,964, leaving an operating income of $191,271, against $165,572 for the previous year.

Record Revenue During February

Reports received by the ELECTRICAL WORLD from central-station systems representing 76 per cent of the generator rating of the country indicate that the total gross revenue from the sale of energy during February was



DAILY REVENUE DURING FEBRUARY TOTALED $4.470,000

$125,200,000, or a daily average of $4,470,000, an increase of 7.1 per cent above February of last year and a record daily revenue for the industry. The operating expenses during February totaled $52,450,000, against $50,720,000 for February, 1924. The operating ratio, or ratio of operating expenses to gross revenue, for companies operating steam-electric generating plants only was 42.9 per cent, the lowest figure recorded since 1920, when data on this item were first collected.

Complete returns indicate that the total gross revenue of the electric light and power industry during 1924 was $1,354,570,000, against $1,269,550,000 in 1923, a gain of 6.7 per cent. The operating and maintenance expenses were $617,980,000, against $576,880,000 in 1923, a gain of 7.3 per cent.

Oklahoma Gas & Electric to Increase Capital.—The stockholders of the Oklahoma Gas & Electric Company will vote May 14 on authorizing the creation of bonded indebtedness to the amount of $300,000,000 at any one time outstanding and on authorizing an increase of the capital stock to $35,000,000 by changing the authorized preferred stock from $10,000,000 to $25,000,000.

Criticise Foreign Loans

Protests Against Issues Insufficiently Safeguarded Arouse Interest at Capital

DURING the past year there have been successfully floated in this country numerous sizable loans by foreign industrial and public utility companies. Outstanding examples were the fifteen-million-dollar offering of the Great Consolidated Electric Power Company, Ltd., of Japan in first mortgage bonds; the ten-million-dollar issue of the Allgemeine Elektricitäts - Gesellschaft (German General Electric Company) in gold debentures; the fifteen-million-dollar issue of the Aktiengesellschaft Sächsische Werke (the Saxon Public Works, Inc.) in first mortgage gold bonds, and the fourteen-million-dollar offering of the Ujigawa Electric Power Company, Ltd., one of the larger and older hydro-electric power companies in Japan.

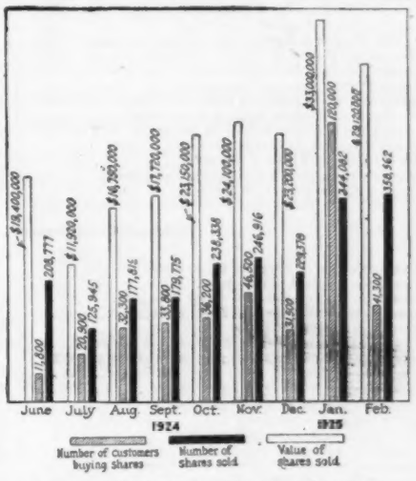
Without casting the least reflection on the character of any of the loans just enumerated, it is interesting to learn that so many protests are being received from those who oppose unsafeguarded foreign loans that some consideration of the general question is in progress in Washington. It is contended, according to our Washington correspondent, that American bankers should attach certain conditions to the use of American money by foreign industrialists. One of the conditions which has been proposed is that no portion of the money be expended in certain trade practices. Another is that Americans shall have an opportunity to bid on supplies to be purchased with the money loaned. American bankers are providing the sinews with which goods made in this country are being deprived of foreign markets, it is contended. Some large German firms are obtaining foreign business on the strength of their ability to arrange for the financing of the project in the United States. American bankers recently financed a railway electrification project. All of the equipment was purchased in Germany. There is a feeling that bankers could favor applicants for loans, who are willing to spend at least a part of the money in the United States.

The bankers point out that New York has become a world financial center. The money they are loaning is not all American money, by any means. The aggregate of foreign deposits in New York is very large. Finance, they point out, is cosmopolitan, not national. For American banks to attempt to handle their resources in a narrow, nationalistic way would destroy confidence and would rob the United States of its financial leadership, it is believed. Loans are based on security. When ample security is tendered it would be contrary to the ethics of banking to attempt to attach conditions as to the proportion of the money to be expended in the United States. Moreover, the bankers say it is to the interest of this country to assist in restoring its neighbors to prosperity in any way they can. Foreign industry must be financed, and they believe it is to the interest of the United States for them to go just as far as they can in making such use of their surplus funds. No American industry is being deprived of adequate financing by the loans being made to foreign industries, it is pointed out.

The suggestion has been made that in the interest of the creditors, as well as of American business, the bankers easily could arrange for representation on the board of directors. Some think this would be the solution of the matter and greatly to be preferred over any effort to apply inflexible conditions.

February Sales to Customers Total $29,120,000

Based upon monthly reports received by the ELECTRICAL WORLD from electric light and power companies selling stock direct to customers and employees, it is estimated that during February a total of 358,562 shares were sold in this manner, a record for any one month. The total value of this



RECORD NUMBER OF SHARES SOLD TO CUSTOMERS DURING FEBRUARY

stock is estimated at $29,120,000, or about $4,000,000 below the January sales. A total of 41,300 customers and employees purchased the stock, making an average sale to each such customer of $705, an unusually high figure.

Tyrol Power Bond Issue Floated

Another foreign loan was floated during the past week when thirty-year first mortgage sinking-fund gold bonds of the Tyrol Hydro-Electric Power Company amounting to $3,000,000 were offered the general investing public. The Tyrol company was originally formed to take over from the Innsbruck municipality the famous Achensee Lake, a natural reservoir immediately above Innsbruck at an altitude of about 3,000 ft. The development of the Achensee superpower installation, with its capacity of 100,000 hp. and with its transmission lines connecting the various plants, will be of great importance to northern Italy, Switzerland and southern Bavaria. These bonds, guaranteed jointly by the State of Tyrol and the City of Innsbruck, were priced at 96½ and accrued interest to yield 7.80 per cent.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.)

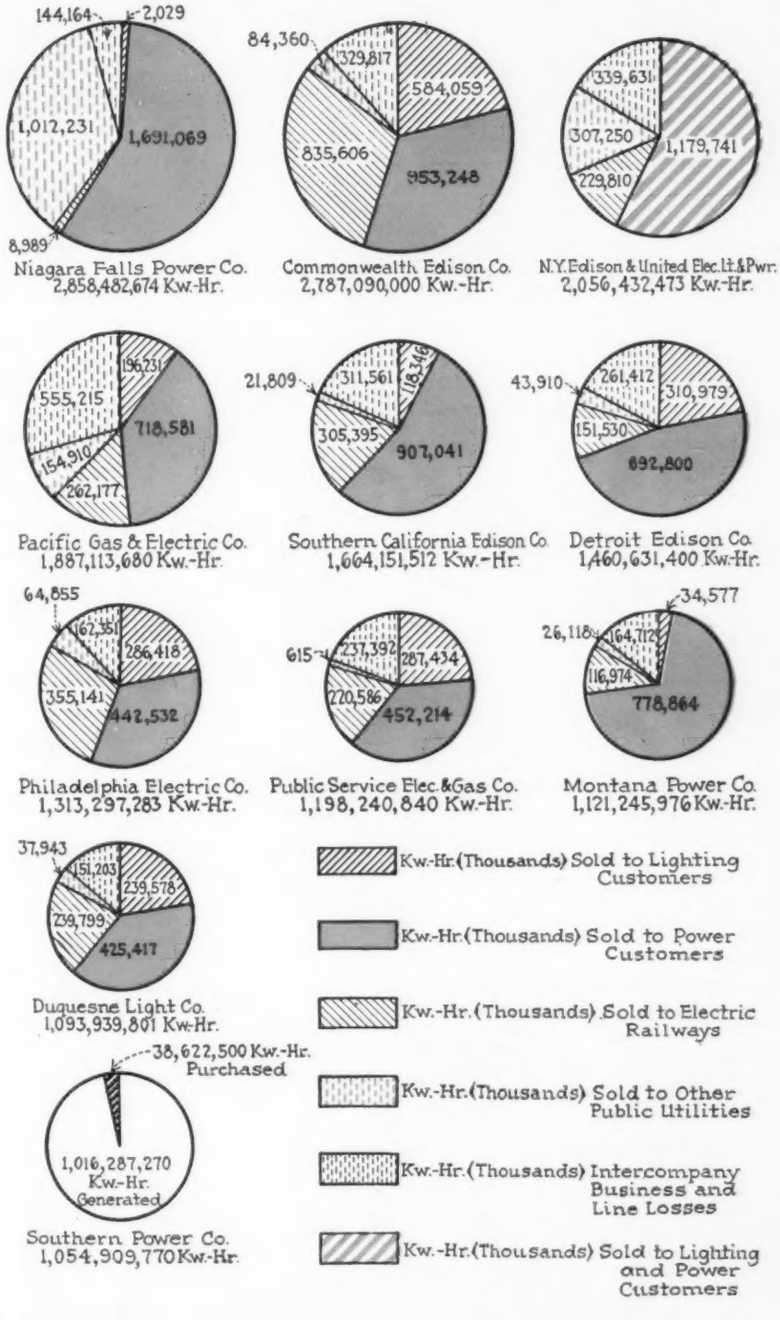
Companies	Bid Price Saturday, April 25	Low 1925	High 1925
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	99	98	102
Appalachian Power, 7 per cent	97½	92	100
Arkansas Light & Power 7 per cent	93½	92	98
Asheville Power & Light 7 per cent	*a* 99	99	100
Central Illinois Public Service 6 per cent	90	84	93
Colorado Power 7 per cent	94	93	98
Connecticut Light & Power 7 per cent	106	105	110
Consumers' Power 6 per cent	91½	90	93½
Dayton Power & Light 6 per cent	92	88	100
Duquesne Light 7 per cent	107½	105	107½
Eastern Texas Electric 6 per cent	100	100	105
Empire District Electric 6 per cent	78	78	85
Fort Worth Power & Light 7 per cent	*a*101	100	102
Great Western Power 7 per cent	98		
Illinois Northern Utilities 6 per cent	88	82	92
Illinois Power & Light 7 per cent	94	92½	98
Kansas Gas & Electric 7 per cent	99	99	99½
Long Island Lighting 7 per cent	101	100	105
Minnesota Power & Light 7 per cent	98	97	98½
Mississippi River Power 6 per cent	90	87½	92
Nebraska Power 7 per cent	100	99	101
Niagara Falls Power 7 per cent—25	28½	28	29
Niagara, Lockport & Ont. Power 7 per cent	105½	101½	110
Northern States Power 7 per cent	96	95	100
Ohio Public Service 7 per cent	97	97	100
Pacific Gas & Electric 6 per cent	95	92	97
Pacific Power & Light 7 per cent	99	99	100
Penn-Ohio Power & Light 7 per cent	94	91	100
Pennsylvania Power & Light $7—no par	*a*101	100	101½
Penn. Public Service 7 per cent	90	90	100
‡Philadelphia Electric 8 per cent—25	37¼	37½	45
Southern California Edison 8 per cent	118	115	122
Tennessee Electric Power, 6 per cent	81	80	84
Texas Power & Light 7 per cent	99½	99½	101
Utah Power & Light 7 per cent	99½	98½	100½
Western States Gas & Electric 7 per cent	89	82	89
Yadkin River Power, 7 per cent	*a* 99	98	100
Holding Companies			
American Gas & Electric 6 per cent—no par	84	84	89
American Light & Traction	95½	93	97
American Power & Light 6 per cent	85½	84	90
American Public Service 7 per cent	91	88	94
American Public Utilities 7 per cent	88	87	95
American Water Works & Electric 7 per cent	101	100	103
Associated Gas & Electric 7 per cent—1 per cent extra—no par	*a* 52		
Carolina Power & Light 7 per cent	102	100	105
Central Indiana Power 7 per cent	89	88	95
Cities Service 6 per cent	81	80	83
Commonwealth Power 6 per cent	81	80	82½
Consolidated Gas 6 per cent—50	59	57½	59
Continental Gas & Electric 7 per cent pr. pf.	90	89	95
Electric Bond & Share 6 per cent	102½	102	104
General Gas & Electric—$8—no par	109	104½	111
*Middle West Utilities 7 per cent	97	91½	98⅜
National Power & Light—$7—no par	97	95	99
North American 6 per cent—50	*a* 48⅜	46½	49
Public Service Corp. of N. J. 7 per cent	101	99	102
Public Service Corp. of N. J. 8 per cent	110	108½	112½
Standard Gas & Electric 8 per cent—50	*a* 52½	50½	53⅞
†United Gas Improvement—50	57⅜	56⅜	58½
United Light & Power—$6.50—no par	81	81	88
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	55½	31	62
Appalachian Power—no par	77	70	83
Arkansas Light & Power	75	65	85
Brooklyn Edison	130½	120½	133
Buffalo General Electric—no par (new)	51	44	51½
*Commonwealth Edison	133½	130½	139
§Consolidated Gas, Electric Light & Power	35	32	35½
Dayton Power & Light	420	180	460
Detroit Edison	*a*116½	110	119
|| Edison Electric Illuminating of Boston	202	200	207½
Kentucky Hydro-Electric	92½	85½	92½
Long Island Lighting (new)	84	60	85
Mississippi River Power	40	37	42
Montana Power	*a* 67½	64	72
Niagara Falls Power—no par	57	45½	58
Niagara, Lockport & Ontario Power—no par	60	60	73
Northern Ohio Power	7½	5	7½
Northern States Power	108	103	110
North Texas Electric	60	60	70
Pacific Gas & Electric	*a*105¼	102½	108½
‡Penn Central Light & Power—no par	63	60	64½
§Pennsylvania Water & Power	129⅜	126½	133½
‡Philadelphia Electric—25	38	37½	45½
Public Service Co. of Northern Illinois	114	97	116
Puget Sound Power & Light	49	49	58
Southern California Edison	106½	102	107½
Tennessee Electric Power—no par	59	47	61
Virginia Power	65	65	92
Virginia Railway & Power	*a*102½	64½	102½
West Penn. Co.	*a*114	105	120
Holding Companies			
American Gas & Electric—no par	73	70	80
American Light & Traction	138	138	153
American Power & Light	54	52	67
American Public Utilities	74	70	85
American Water Works & Electric	*a* 49½	34⅜	49½
Associated Gas & Electric, Class A	*a* 28⅛		
Carolina Power & Light—no par	335	290	350
Cities Service (new)	35	34	43
Columbia Gas & Electric—no par	*a* 57½	45⅜	59
Commonwealth Power Corp.—no par	115	106	126
Consolidated Gas—no par	*a* 79	74½	79¾
Continental Gas & Electric	81	77⅜	90
Electric Power & Light	*a* 19½	17⅜	19½
Federal Light and Traction	144⅜	114½	148½
General Gas & Electric	78	72	82
Lehigh Power Securities—no par	102	82	116
*Middle West Utilities—no par	88½	82½	102⅜
National Power & Light—no par	243	185	255
North American—10	*a* 45½	41½	49
Philadelphia Co.—50	*a* 54½	51½	57½
Power Securities—no par	8		
Public Service Corp. of N. J.—no par	*a* 65½	62⅜	72½
Standard Gas & Electric—no par	*a* 45⅜	40½	47½
United Gas & Electric (Conn.)—no par	28½	26	37½
Utah Securities	*a* 88	41½	88
BONDS			
Operating Companies			
Adirondack Power & Light	6s 1950	104	102½ 105
Alabama Power	5s 1946	97½	96 98
Appalachian Power	5s 1941	97½	96 98
Brooklyn Edison	5s 1949	101	99½ 101½
	6s 1930	105	104 105½
Cleveland Electric Illuminating	5s 1939	100½	100 101¼
Commonwealth Edison	5s 1943	100½	99½ 101
	5s 1953	99½	98½ 99½
§Consol. Gas, Elec. Lt. & Pwr.	4½s 1935	96½	93½ 97½
	6s 1949	107½	104½ 107½
Consumers' Power	5s 1936	93½	93 94½
	5s 1952	95½	90½ 95½
Detroit Edison	5s 1933	101½	99½ 102½
Duquesne Light	6s 1949	105½	104½ 107
Great Western Power	5s 1946	97	95 97½
Kansas City Power & Light	5s 1952	98½	95½ 98½
Mississippi River Power	5s 1951	98½	96½ 99
Montana Power	5s 1943	98½	97½ 99½
New England Power	5s 1951	100½	100½ 101½
New York Edison	6½s 1941	113½	112 115
Niagara Falls Power	6s 1932	105½	103½ 105½
Northern States Power	5s 1941	96½	93 97
	6s 1941	104½	103 107½
Ohio Power	7s 1951	106½	106½ 107½
Pacific Gas & Electric	5s 1942	96½	93½ 97
Pennsylvania Water & Power	5s 1940	100	99½ 101
‡Philadelphia Electric	5s 1966	101¼	100¼ 102
	5½s 1947	105½	103½ 105½
	6s 1941	107½	106 107½
Portland Electric Power	6s 1947	97	94 99½
Southern California Edison	5s 1939	99	99 100½
	6s 1944	103½	102½ 104½
Tennessee Electric Power	6s 1947	101	99½ 102½
Texas Power & Light	5s 1937	97½	97 98
Toledo Edison	7s 1941	109½	108½ 110½
Utah Power & Light	5s 1944	97⅜	91 95¼
Holding Companies			
Alabama Traction, Light & Power	5s 1962	87½	86 90
American Gas & Electric	6s 2014	96½	96½ 97
American Power & Light	6s 2016	95	94 95½
Amer. Water Works & Electric	5s 1934	95½	92½ 96¾
Associated Gas & Electric	6½s 1954	*a*100½	
Central Indiana Power	6s 1947	97½	95½ 98½
Commonwealth Power	6s 1947	100½	97½ 101½
Consolidated Cities Lt., Pwr. & Tr.	5s 1962	79½	75½ 80½
Illinois Power & Light	6s 1953	100	100 102
United Light & Railways	5s 1932	95½	93½ 96
	6s 1952	97½	95½ 99¼
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing	*a*106	103½	107
*National Carbon	124	120	124
Worthington Pump & Machinery A	84	79	88
COMMON STOCKS			
Allis-Chalmers Manufacturing	*a* 77½	71½	86½
American Bosch Magneto—no par	*a* 30	26½	54½
Electric Storage Battery—no par	*a* 62⅜	60½	70½
General Electric	*a*268	227½	320
General Electric—10	*a* 11½	11	11½
*Hurley Machine—no par	44½	41½	56
†Wagner Electric	37	26½	50
Westinghouse Electric & Manufacturing—50	*a* 67½	66½	84
Worthington Pump & Machinery	*a* 46½	42½	79½
BONDS			
General Electric	3½s 1942	83½	83 84
	5s 1952	105	101½ 105½
Robbins & Myers	7s 1952	66½	65 73¾
Western Electric	5s 1944	100¼	98 100½
Westinghouse Electric & Mfg.	7s 1931	107¾	107½ 108½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. || Boston Stock Exchange. § Baltimore Stock Exchange.
a Bid price, low and high, Tuesday, April 28.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

How the Billion Kilowatt-Hour Systems of the Country Distributed Their 1924 Output



Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

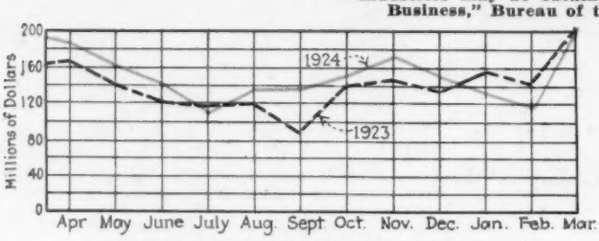
Individuality Within Industry

THE statement is often heard that no two human beings look alike, act alike or think alike —that as creatures of an environment which through their forefathers has extended back thousands of years, each man and woman has acquired certain attributes which distinguish him or her from any one else. This is true not only of humanity; it is equally true of industry, and particularly of the electric light and power industry. As each operating company has an entirely different history of development, a distinctive field to serve, and has been operated under policies differing in detail from those of any other company, so the present activities of each company adhere to certain acquired characteristics.

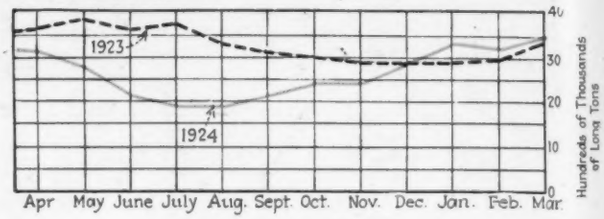
During 1924 there were fourteen electric light and power systems in the United States and Canada with an output of more than one billion kilowatt-hours, of which eleven were operating in the United States. A glance at the accompanying chart will bring out the widely varying characteristics in the operations of these super-systems. Some of them, such as the Niagara Falls Power Company, the Southern California Edison Company and the Montana Power Company, sell a major portion of their energy for power purposes, although in the three instances cited the energy is largely used for entirely different industrial purposes — electrochemical processes, pumping and mining respectively. Other companies serving large metropolitan areas sell a considerable portion of their energy for lighting purposes, while still others contribute largely to the electrification of city and interurban railways. Each company is a unit unto itself with an individual story of operations to tell.

How the Primary Industries Are Trending

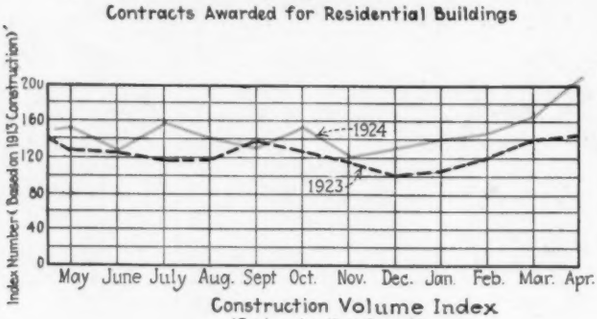
All data except that on "Volume of Construction" and "Construction Cost" are supplied monthly by the Bureau of the Census. Similar data on other industries may be obtained from the "Survey of Current Business," Bureau of the Census, Washington, D. C.



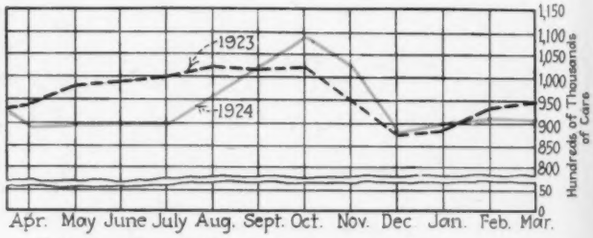
Contracts Awarded for Residential Buildings



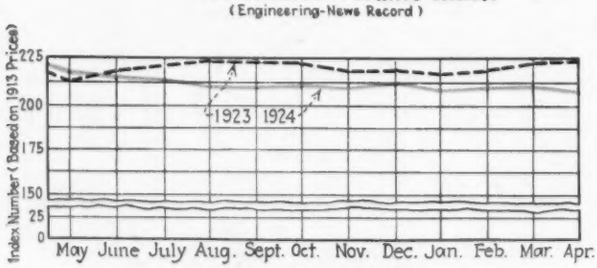
Pig-Iron Production



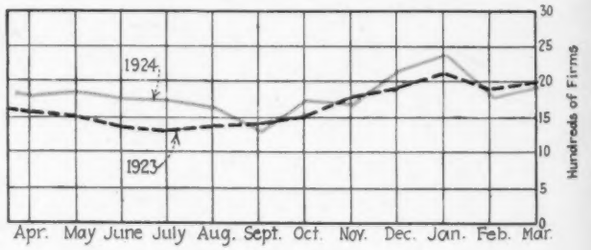
Construction Volume Index
(Engineering-News Record)



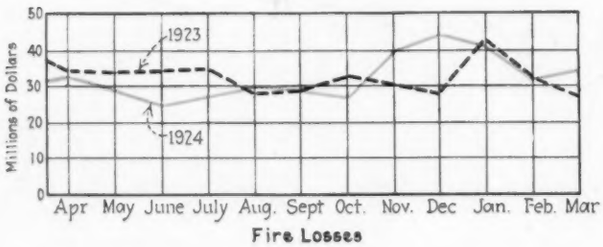
Total Average Weekly Freight-Car Loadings



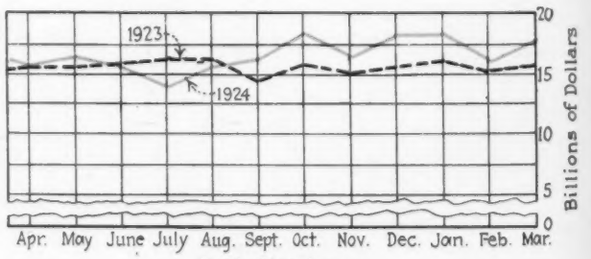
Construction Cost Index
(Engineering-News Record)



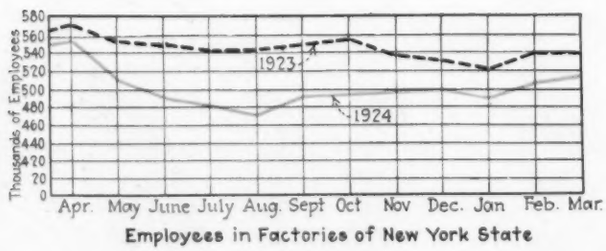
Business Failures



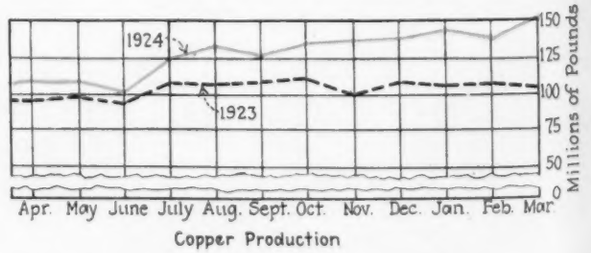
Fire Losses



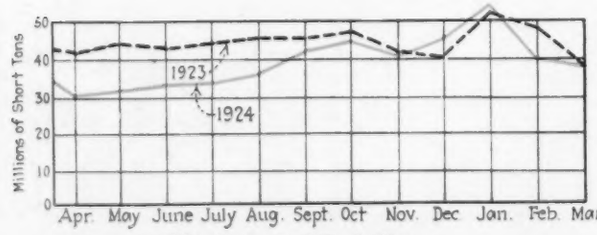
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Industrial Production Continues Above Normal

MARCH found industrial production still well above normal, although trade conditions in general were reported as dull. March, however, was very erratic, as is made evident by the fact that during that month both the high and the low points of the year in security prices were registered.